DOCUMENT RESUME

ED 179 420 SE 029 448

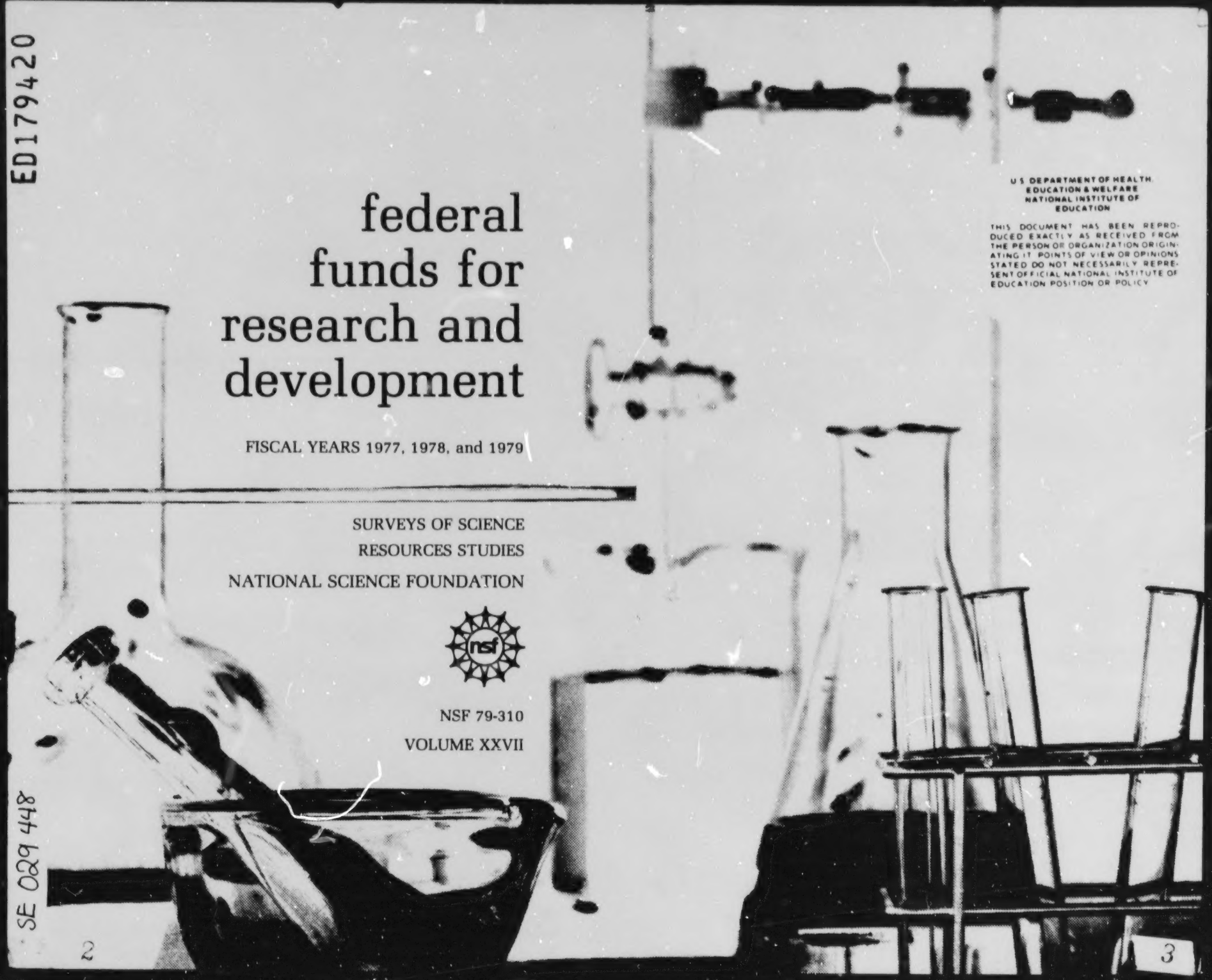
AUTHOR	Stoddard, Eleanor; And Others
TITLE	Federal Funds for Research and Development Fiscal Years 1977, 1978, and 1979. Volume XXVII.
INSTITUTION	National Science Foundation, Washington, D.C. Div. of Science Resources Studies.
REPORT NO	NSF-79-310
PUB DATE	Jun 79
NOTE	105p.; Contains occasional small print and shaded charts and graphs which may not reproduce well; For related document, see ED 161 726
AVAILABLE FROM	Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 (Stock No. 038-000-00422-1: $2.50)
EDRS PRICE	MF01/PC05 Plus Postage.
DESCRIPTORS	Data Bases; Development; *Federal Programs; *Financial Support; *Higher Education; Mathematics; *National Surveys; Research; Science Education; *Sciences; *Scientific Research; Statistical Data

ABSTRACT

This report provides data on Federal funds for research and development for the period from 1977-1979. The data show Federal R&D funding levels as reported by 94 agencies in March through May of 1978, and are based on agency budgets as incorporated in the President's 1979 budget message to Congress. This report is based on three years of the 1979 Federal budget period. Data for the fiscal year 1977 are actual, but data for the next two years are tentative. All agencies with R&D programs are included. R&D totals are given in both outlays and obligations, and the R&D obligational data are distributed by character of work, field of science (for basic research and applied research), and Federal R&D support by states. Research performed at universities and colleges by field of science is shown separately. R&D plant data are also provided. (Author/HM)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED179420



federal funds for research and development

FISCAL YEARS 1977, 1978, and 1979

SURVEYS OF SCIENCE
RESOURCES STUDIES
NATIONAL SCIENCE FOUNDATION

NSF 79-310
VOLUME XXVII

U S DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

SE 029 448

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington, D.C. 20402 - Price $2.50
Stock Number 038-000-00422-1

Related Publications

REPORTS	NSF No.	Price
Federal Funds for Research and Development Fiscal Years 1977, 1978, and 1979 Volume XXVII	78-312	—
An Analysis of Federal R&D Funding by Function: Fiscal Years 1969-79	78-320	$2.50
National Patterns of R&D Resources: Funds and Personnel in the United States, 1953-1978/79	78-313	$2.40
DETAILED STATISTICAL TABLES		
Research and Development in Industry, 1976	78-314	—
HIGHLIGHTS		
"Defense and Space Lead in Federal R&D Growth in the 1979 Budget"	78-317	—
"Congressional Actions Raise R&D Total in 1979 Federal Budget"	79-300	—

Availability of Publications

Those publications marked with a price should be obtained directly from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Where no price is listed, single copies may be obtained gratis from the National Science Foundation, Washington, D.C. 20550.

(See inside back cover for Other Science Resources Publications).

FOREWORD

Federal R&D funding plays an important role in the development of the Nation's technological capability and, thus, its economy. Federal agencies provide almost one-half of the funds expended for research and development in the United States and more than two-thirds of the basic research funds. Over the years many industries and most research universities have become heavily dependent on Federal support and make their plans with this factor in the background. Decisionmakers in such institutions, as well as their counterparts in the Federal establishment, need analyses of R&D funding levels that reflect both administration policy, as embodied in budget requests, and subsequent congressional response as background information on the kinds of changes that can occur.

This report provides data based on a survey of Federal agency R&D program requests in the President's 1979 budget and includes, as well, an analysis of changes in request levels made by subsequent congressional appropriations. The analysis additionally provides preliminary data on relative changes in R&D funding levels of individual agencies, and all agencies combined, between 1978 estimates and 1979 estimates, as originally presented by the administration and as seen one year later.

Another feature of this report is a retrospective analysis of Federal research as an entity deserving special treatment. Research support since World War II is covered, including a discussion of the nature of agency programs and the effects of program directions on fields and performers.

Richard C. Atkinson
Director
National Science Foundation

June 1979

notes

The data for fiscal years 1977-79 shown in the appendix tables and the text tables were collected from the agencies in March and April 1978 and are based on agency budgets as incorporated in the President's 1979 budget message to Congress. The 1979 data reflect requests for fiscal year 1979 and thus do not reflect subsequent congressional appropriations or changes made by executive apportionment. Fiscal year 1978 data represent obligations estimated in the second quarter of fiscal year 1978 and reflect congressional appropriation actions.

Table and chart details may not add to totals because of rounding.

Significant changes in 1979 program requests resulting from congressional actions taken at the time that this report was prepared are noted in the text.

To obtain accurate historical data use only the latest appendix C tables for *Federal Funds*, Volume XXVII and do not use earlier data. Prior-year data are revised from time to time by the agencies when changes occur in program classification.

acknowledgments

This report was prepared in the Division of Science Resources Studies under the general guidance of Charles E. Falk, Director and William L. Stewart, Head, R&D Economic Studies Section. Benjamin L. Olsen, Study Director, Government Studies Group, provided direction. Eleanor Stoddard was responsible for organizing and writing the report. Dorothy K. Ham prepared statistical materials and graphic illustrations.

CONTENTS

Highlights vii

Introduction viii

Section:

1. Federal R&D Perspectives 1
   - The Budget Cycle 2
   - Congressional Actions on 1979 Budget Requests 3
   - Variation in Budget Estimates 4
   - Share of Budget 5
   - Relationship to National R&D Total 6
   - Relationship to GNP 7
   - Character of Work 7
   - Performers 8

2. Research Perspectives 12
   - Long-Term Trends 12
   - Performers 14
   - Universities and Colleges 16
   - Fields of Science 18
   - Agency Programs, 1969-79 20

3. Geographic Distribution, 1977 25
   - Synopsis 25
   - Trends in State Support 26
   - Distribution of Funds by Performer 30
   - R&D Plant 31

Appendixes:

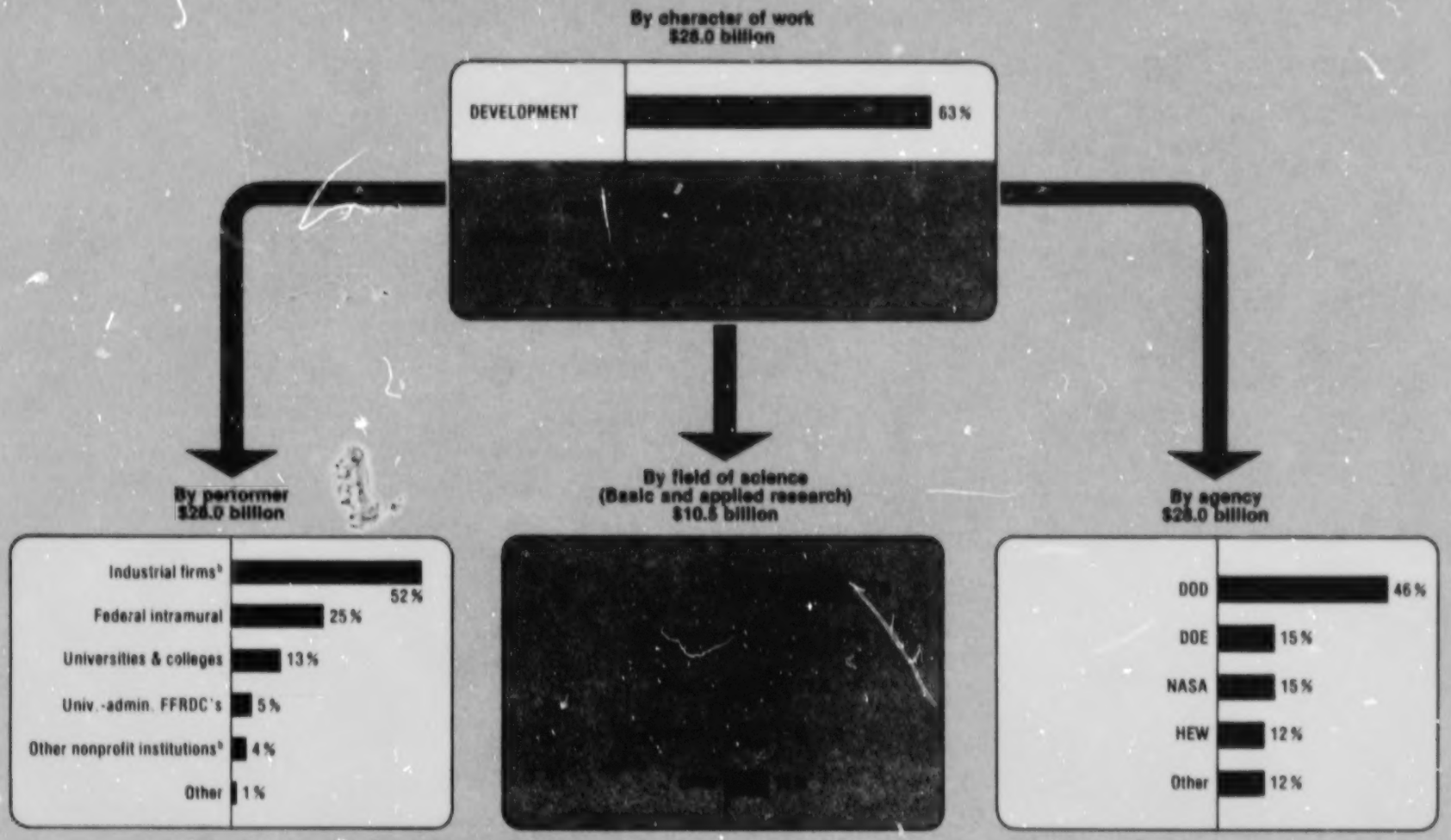
A. Technical Notes 34

B. Federally Funded Research and Development Centers, Fiscal Years 1977-79 39

C. Listing of Statistical Tables and Summary Tables[1] 40

[1] See note on p. 33.

Distribution of Federal obligations for research and development: FY 1979 (est.)[a]



[a]These data are based on the President's 1978 budget to Congress and exclude data on R&D plant.
[b]Includes federally funded research and development centers (FFRDC's) administered by this sector.
SOURCE: National Science Foundation

HIGHLIGHTS

- Over the 1969-79 decade the variation between the R&D total as requested in the President's budget for the budget year and the final R&D total made available for that year—after congressional actions and agency reprogramming—has tended to decrease. Since 1971 it has been less than 5 percent each year, with one slight exception. Final totals have usually been lower than requested totals, but in 1977 and 1978 the final totals were higher, and in 1979 the final total is again expected to be higher than the total originally reflected in the President's budget.
- The President's 1979 budget included an overall R&D obligation request of $28.0 billion, or 6 percent more than the 1978 level. Subsequent congressional appropriations, principally in the health and energy areas, raised the total to 9 percent more than the previous year. Supplemental requests for 1979, chiefly in defense and space, were later acted upon and raised the overall Federal R&D increase to 11 percent over 1978.
- In 1976 the share of R&D and R&D plant outlays within the overall Federal budget was 5.8 percent, a ratio that has been approximately maintained ever since. This ratio compares with a high point of 12.6 percent in 1965. In the intervening years the share fell steadily, chiefly as a result of increasing Federal payments to individuals under legislatively mandated programs like social security and medicare and growing grants to States and localities.
- Between 1969 and 1979 the ratio of national R&D expenditures to the gross national product (GNP) has dropped steadily, from 2.7 percent to an estimated 2.2 percent. Despite consistent current-dollar growth in national R&D expenditures, with notable increases since 1975, the growth of GNP has been greater.
- The Federal Government continues to play the leading role in national R&D support, but the Federal portion of the national total has been slowly declining. In 1979 Federal agencies are expected to account for almost 50 percent of total national R&D expenditures compared with 58 percent in 1969. The industry share is now 47 percent compared with 39 percent 10 years ago.
- Greatest growth in Federal support in the past decade has been seen in the research end of the R&D spectrum, most of the growth occurring since 1973. Annual growth rates for research of 11 percent to 12 percent in the 1976-78 period reflect a special emphasis on basic research. The increase of 6 percent in total research funding in the President's 1979 budget proposal was raised to 13 percent by the Congress with significant increases shown for both basic research and applied research.
- The chief site of Federal research performance has nearly always been the agency intramural laboratory. This contrasts with R&D activities taken as a whole, where industry is the predominant performer. In the 1969-79 period the intramural share of total Federal research performance has not changed significantly; it has been 35 percent in most years. The university-and-college share of total Federal research support has tended to grow, notably after 1970 when it was 25 percent, to an estimated 31 percent in 1979. Industrial firms have accounted for approximately 20 percent of the research total.
- At present the life sciences account for 34 percent of all Federal research activities; their growth has been closely tied to the growth of biomedical research. Engineering now accounts for 27 percent of the research total with chief support derived from defense and space programs. The physical sciences make up 17 percent of all Federal research activities.
- In the earlier years of the 1969-79 decade, applied research funding by Federal agencies grew more rapidly than funding for basic research. Starting with the 1977 budget, however, special emphasis has been placed on basic research, and funding has increased accordingly. Thus, total basic research obligations in the 1979 budget represented a constant-dollar level 7 percent above that of 1969. Applied research obligations were 22 percent above 1969 on a constant-dollar basis.
- The 1979 budget included record funding for development, a high in current dollars but a slight decrease from 1978 in constant dollars. Subsequent actions, primarily the restoration of energy development programs by Congress and the supplemental requests for defense and space development programs, produced a slight real increase in Federal development obligations in 1979.

INTRODUCTION

The data in this report show R&D obligational levels as reported to the *Federal Funds for Research and Development*, Volume XXVII survey that was conducted by the National Science Foundation (NSF) in March through May of 1978. A total of 94 Federal agencies responded, representing all those that sponsor R&D programs. Their responses were based on requests to Congress for fiscal year 1979, as shown in the President's 1979 budget. The survey is a more detailed categorization of Federal R&D programs than that which appears with the budget document.[1]

This report, and the appendix tables that were released earlier in a separate document,[2] display Federal R&D data by agency, character of work (basic research, applied research, and development), performer, and field of science for the 1977-79 period, and by State distribution for 1977. The appendix tables provide the current data in considerable detail and include historical data as well.

This report is based on the three years of the 1979 Federal budget period. Data for fiscal year 1977 are actual, but data for the next two years are tentative. Fiscal year 1978 data reflect obligations estimated in the second quarter of fiscal year 1978, including obligations carried over from prior-year appropriations as estimated by the agencies at the time. Fiscal year 1979 data are based on amounts requested in the President's 1979 budget. While data for many agencies include estimates for carryovers into 1979, they do not reflect subsequent appropriations or changes made by executive apportionment.

[1] See Office of Management and Budget, *Special Analyses, Budget of the United States Government, Fiscal Year 1979*, "Special Analysis P: Research and Development" (Washington, D.C.: Supt. of Documents, U.S. Government Printing Office), 1978, p. 305.

[2] See National Science Foundation, *Federal Funds for Research and Development, Fiscal Years 1977, 1978, and 1979: Detailed Statistical Tables*, Volume XXVII (NSF 78-312) (Washington, D.C., 1978.) These are obtainable gratis from NSF.

The analysis in this report makes special note of the effects of congressional actions on the R&D requests for 1979, bringing the funding history for 1979 up to date in broad outlines through the 1980 budget estimates. A fairly reliable picture emerges of ultimate 1979 relationships as to agency R&D support, overall character-of-work support, and the distribution of funds to performers and fields. Data for 1979 will not become "actual" until the 1981 budget however, and by that time further modification will have occurred in these relationships.

Some underreporting occurs in the case of intramural R&D support in that retirement funding for Federal personnel is not included at present. Efforts have been started to correct this deficiency, and in future reports such data should be included.

While the statistics in the *Federal Funds* survey do not reflect the precision used for accounting purposes, they are comparable from one year to the next and provide a useful measure of trends. Borderline problems exist in that some R&D programs are not clearly defined as such. Most agency R&D programs have to be separated by agency respondents from other, larger programs because they are not identified as budget line items, and sometimes questions arise as to appropriate classification. R&D programs, once identified, must then be further subdivided into the survey categories: Basic research, applied research, development, performers, and fields. Since agency records are often kept by categories other than those requested in the survey, judgment in reporting data must be used by the respondents. Over the years, however, the respondents have gained considerable experience in meeting the survey requirements, and their efforts to report consistently according to established definitions have continued to increase the reliability of the data.

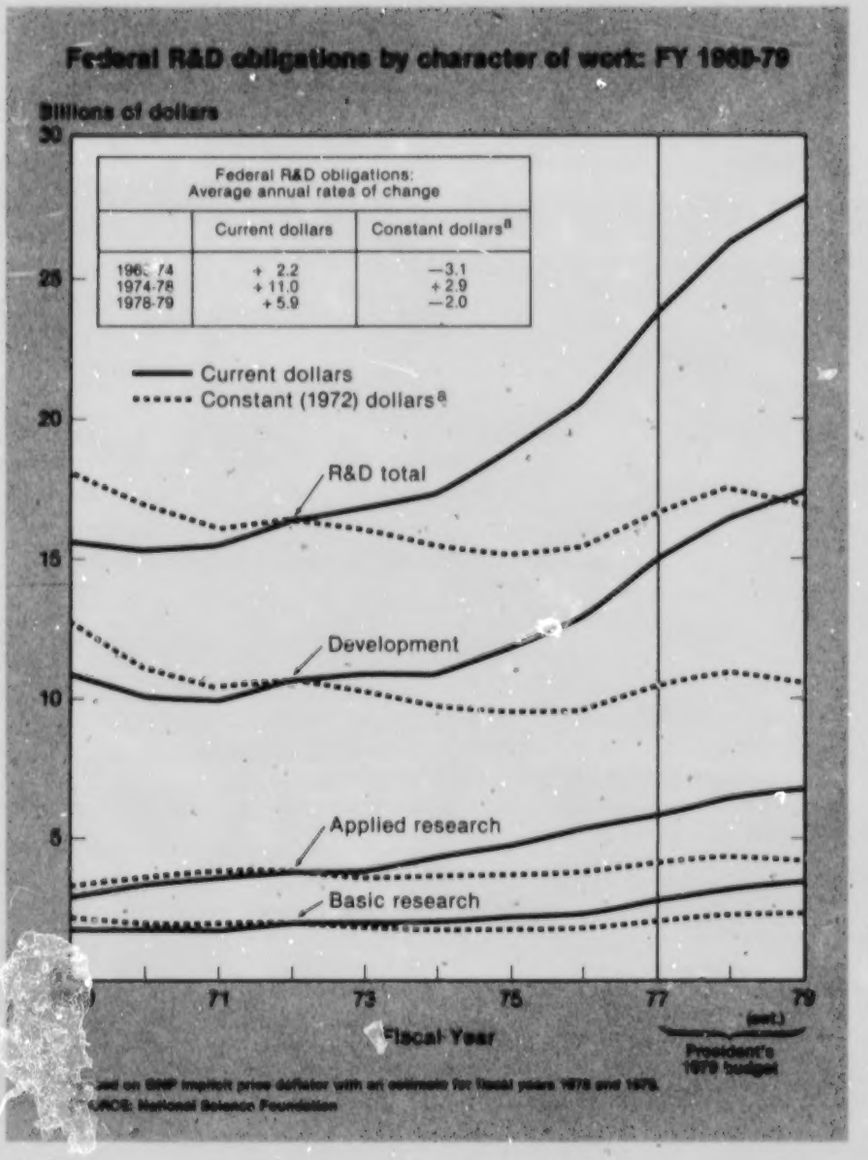
Section 1. FEDERAL R&D PERSPECTIVES

A significant feature of the President's 1979 budget to Congress was an R&D obligational total that did not exceed anticipated inflation for the first time in four years. The R&D obligations of Federal agencies (plant excluded) made up a total of $28.0 billion in the budget proposal for fiscal year 1979, an increase of 6 percent over the previous year. This total compares with an estimated $26.4 billion for fiscal year 1978, which was 10 percent higher than the total for fiscal year 1977.

Contributing to the slower pace of growth in the 1979 budget were markedly reduced R&D growth rates for the Department of Health, Education, and Welfare (HEW) and the Department of Agriculture (USDA), and actual declines in R&D funding for the Department of Energy (DOE) and the the Department of Transportation (DOT). All these agencies, especially DOE, had shown significant increases in 1977 and 1978. Program reductions occurred within some other agencies as well as these, but the major impacts on the Federal R&D total were caused by the administration decisions for these four, especially for DOE and HEW.

In the 1979 budget only three agencies among those leading in R&D support reflected real growth for the R&D portions of their budgets. These were the Department of Defense (DOD) with an increase of 9 percent; the National Aeronautics and Space Administration (NASA) with an increase of 8 percent; and NSF with an increase of 10 percent. The fact that DOD and NASA are the leading R&D support agencies helped to sustain the Federal R&D total and produce an increase from the previous year in current dollars, if not in real terms.

The 1979 budget level appeared to represent a turning point. During the 1969-78 period a shift had occurred in the pattern of R&D support. Between 1969 and 1974 changes in Federal R&D funding from one year to the next were slight, largely because of fiscal restraints imposed by concern with inflation. The average annual growth rate in this period was 2.2 percent, or a decline in real terms. Then, between 1974 and 1978, even though concern with inflation persisted, a resurgence of R&D growth took place in response to a number of pressures: the energy crisis, a recognized need to make up for lags in the defense effort; continuing emphasis on health research,



development of the space shuttle, and decisions by two successive administrations to build Federal support for basic research as an essential national resource. The average annual rate of growth in this period was 11.0 percent, or 2.9 percent in constant dollars.[1]

The net effect of innumerable program decisions made separately in the preparation of the 1979 budget was to produce overall R&D growth that did not exceed the rate of inflation as estimated by the administration in January 1978. In the two previous Presidential budgets, overall R&D growth had exceeded anticipated inflation by decided margins. Later congressional appropriations plus adjustments reflecting obligation carryovers from prior years for some agencies resulted in a higher R&D total in 1977, and a higher relative increase, than had been originally indicated in the budget message. The estimated R&D total for 1978 showed a similar pattern. From preliminary data shown in the President's 1980 budget, it appears that the same pattern will be repeated in 1979.

[1] In the absence of a reliable R&D cost index the GNP implicit price deflator has been used for the years 1968-78 and a projected rate of 8 percent, as shown in the 1980 budget document, used for 1979. At the time of the 1979 budget message, however, the projected rate of inflation was 6 percent for 1979.

Federal obligations for research and development by agency: FY 1969 and FY 1977-79

[Dollars in millions]

Agency	Actual		Estimates	
	1969	1977	1978	1979
Total	$15,641	$23,929	$26,419	$27,972
Department of Defense	7,696	10,963	11,825	12,838
National Aeronautics and Space Administration	3,963	3,703	3,876	4,193
Department of Energy	1,406	3,536	4,196	4,175
Department of Health, Education, and Welfare	1,297	2,787	3,132	3,271
National Science Foundation	274	697	754	829
Department of Agriculture	260	547	632	636
Department of Transportation	232	355	407	372
Department of the Interior	208	296	372	359
Environmental Protection Agency	—	295	331	330
Department of Commerce	72	245	288	315
Other agencies	233	504	606	654

SOURCE: National Science Foundation

The Budget Cycle

Each report in the *Federal Funds* series is based on a survey of all Federal agencies sponsoring R&D programs, the data for which are gathered a month or two after the President's budget message for the fiscal year ahead. Budget data are always reported on a 3-year basis: actual data for the fiscal year just completed, estimated data for the current fiscal year, and estimated data for the fiscal year ahead. In this report, which is based on the *Federal Funds*, Volume XXVII survey, obligations were final for 1977, reflected estimates for 1978 *after* congressional appropriations for that year, and showed estimates for 1979 *before* congressional appropriations.

Thus, amounts for 1978 for programs and agencies were not exactly the same as those shown for 1978 in the original Presidential budget for that year. The estimated 1978 data reported to *Federal Funds*, Volume XXVII showed a higher total than had been originally proposed. The next survey produced *final* data for 1978, which varies somewhat from the data shown in the survey on which this report is based. R&D data in broad totals for the three years of the 1980 budget cycle show a slightly higher R&D total for 1978 and a significantly higher relative increase for 1978 over 1977 than were originally indicated in the President's 1978 budget.[2]

Any analysis of estimated Federal R&D funding levels must be related to the time that the data are collected. Actual-year data, once established, change very little except for occasional revisions by agencies of prior-year levels as a result of reclassifications of R&D programs. Estimated-year data, by comparison, reflect actions of the various involved Government bodies at the time of estimation.

The ways in which estimated data can change are illustrated in the chart on the opposite page, which shows percent changes in agency R&D funding levels between 1978 and 1979 and compares the *original* agency funding profile in the President's 1979 budget with the profile in the President's 1980 budget for the *same two years*. The later profile reflects congressional appropriation actions for fiscal year 1979 plus carryovers into 1979 of funds unobligated in prior years. It can be seen

[2] National Science Foundation. *Federal Funds for Research and Development, Fiscal Years 1978, 1979, and 1980: Detailed Statistical Tables*, Volume XXVIII (NSF 79-318) (Washington, D.C.)

that many changes occurred in estimated funding levels. All the leading support agencies except NSF received increases from Congress (or from carryovers) over the amount originally requested.

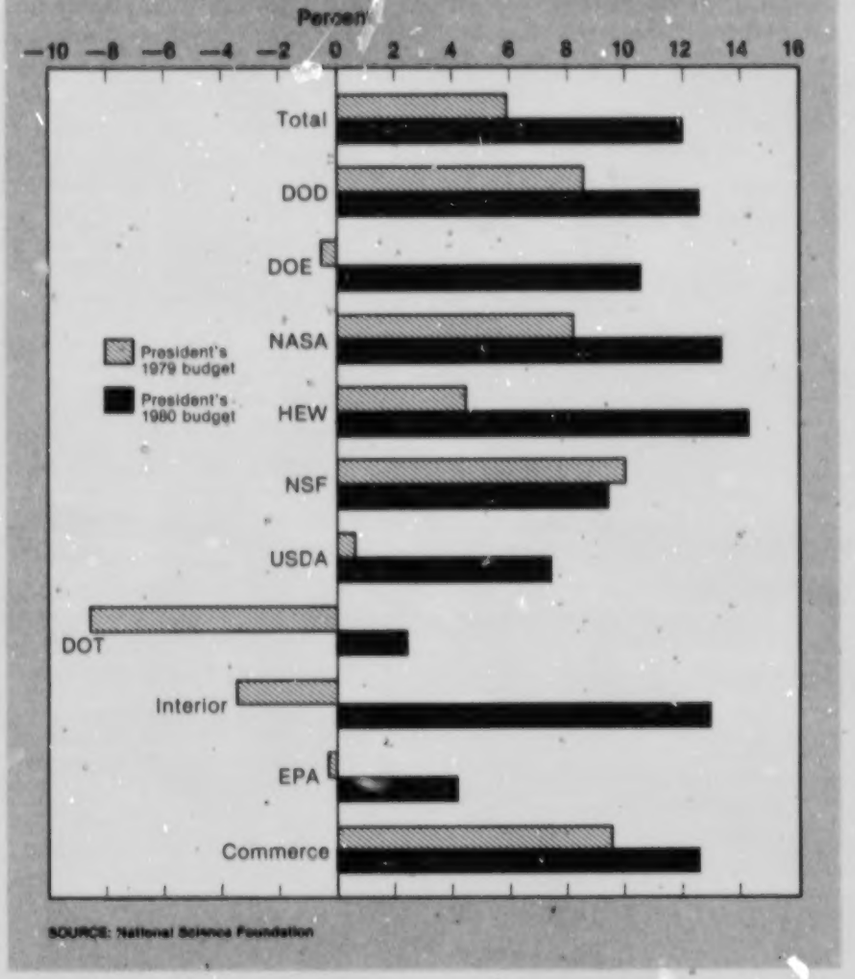
Congressional Actions on 1979 Budget Requests

Congress made decisions on a vast number of programs, which had the effect of raising the estimated increase for 1979 from 6 percent to 9 percent for R&D funding as a whole by the end of fiscal year 1978. Among these congressional decisions certain broad actions are worth noting. For 1979 the Congress cut back slightly on the DOD request and approved virtually the entire NASA request. But after the last session of the 95th Congress these two agencies submitted supplemental requests for 1979, which, if granted, would have changed their R&D obligation increases to 13 percent each. The chief programs for which increases were requested were the DOD M-X intercontinental ballistic missile and air-launched cruise missile and the NASA space shuttle. The 96th Congress subsequently granted the NASA request but only partially granted the DOD request. The effect on the Federal R&D total was to produce an increase of 11 percent in 1979.

DOE R&D support for 1979 now reflects a 10-percent increase over 1978, as a result of congressional actions, instead of a slight overall decrease. The administration request had included reductions in the DOE breeder reactor and fuel cycle programs as well as in solar heating demonstration, and a slight decrease in overall fossil energy programs. Magnetic fusion, solar and geothermal development, and conservation programs were scheduled for increases. Congress restored funds to the breeder reactor program, including the Clinch River demonstration project, and to solar demonstration, and raised the amounts for solar and geothermal energy development.

As for HEW, the original 1979 request level reflected an increase of only 4 percent over 1978. The most recent data now indicate that the increase will be approximately 15 percent. Almost all of this increase is based on the amounts appropriated by Congress to the National Institutes of Health (NIH), which account for four-fifths of the R&D effort within HEW. Congress raised support to all the health institutes in 1979, especially to the institutes on aging, child health and human development, environmental health sciences, and eye diseases. Among the other institutes only cancer and dental research showed increases of less than 14 percent over 1978. Until 1977 the institutes concerned with cancer and heart and lung diseases had been the most rapidly growing.

FY 1978 to FY 1979 percent change in Federal R&D obligation levels, by agency, as shown in two successive Presidential budgets



SOURCE: National Science Foundation

The Alcohol, Drug Abuse, and Mental Health Administration (ADAMHA) accounted for approximately 5 percent of the R&D total of HEW in 1979. A 25-percent increase was requested for the work of ADAMHA, and this was almost entirely granted by the Congress in line with recommendations of the President's Commission on Mental Health.

NSF received a reduction from Congress in its R&D request for 1979, but this reduction was small and mostly affected funding for the Applied Science and Research Applications (ASRA) program. The ASRA program, less than 10 percent of the NSF total, was decreased 25 percent from the request level. The largest reduction was made in the earthquake hazards mitigation program, relating to analysis of structural designs and research on government protective measures. Other reductions were directed to integrated basic research, problem analysis, and community water management.

The estimated R&D growth for USDA from 1978 to 1979 is now 10 percent as a result of congressional action. The USDA requested total in R&D obligations for 1979 amounted to a leveling off, or a decline in real terms. The USDA requests for Agricultural Research (AR) and for the Forest Service (FS) were raised somewhat by the Congress. Cooperative Research (CR), however, representing work that is carried out by agricultural experiment stations, was raised 10 percent over the 1979 request level, or 22 percent over 1978, although the competitive research grants program, initiated in 1978, was reduced to one-half the requested level.

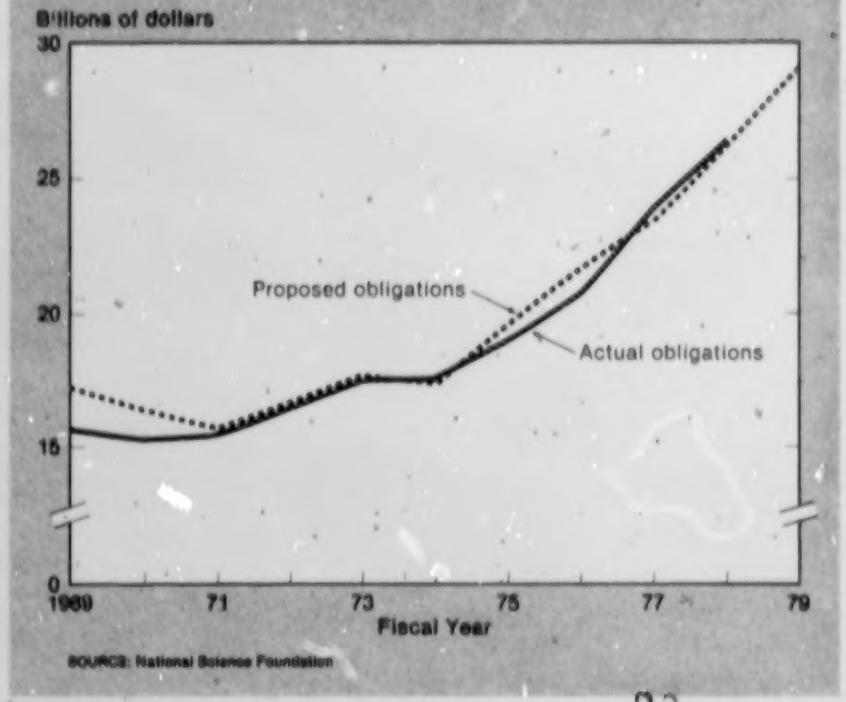
Other agencies that now show increases in R&D support between 1978 and 1979 whereas they had shown decreases in the 1979 budget are DOT, the Department of the Interior, and the Environmental Protection Agency (EPA). In the case of DOT the Congress actually reduced the amount requested for 1979, but funds carried over from prior-year appropriations will have the effect of a small increase in support in 1979 over 1978. For Interior the chief congressional increase was for mined land demonstration projects that had been eliminated by the administration. This and other smaller increases brought the overall increase for Interior to 9 percent in 1979. EPA had reflected a decrease in the 1979 budget as a result of funds carried over in 1978. Congress approved a small overall increase in R&D funds for EPA although reducing the request for the anticipatory research program. EPA now shows a 4-percent increase in 1979.

Variation in Budget Estimates

While the estimated Federal R&D increase for 1979 now reflects completed congressional actions, some of it is derived from funds carried over from 1978. By the time all other actions for 1979 are final, the relative increase could be reduced; some of the funds expected to be obligated in 1979 could be carried over into 1980. The possibility of such shifting is present in all Federal budget data and can bring about changing relative growth patterns for a given period until all data become "actual."

Over the past decade the pattern in Federal R&D funding—budget year to actual year—is fairly consistent. By comparing the Federal R&D obligational total, as shown in the budget proposal, with the final R&D obligational total for the same year, it is seen that in most years of

Comparison of estimated Federal R&D obligations as originally proposed for Federal budget years with Federal R&D funds actually obligated for those years



SOURCE: National Science Foundation

22

23

the 1969-78 period the actual year total was lower than the total originally proposed. But since 1969 and 1970, when actual obligations proved to be considerably lower than those originally proposed, as a result of congressional reductions and delay in appropriations, the relative change has not been great. Based on observations covering the years since 1970, a reasonable expectation is that the final Federal R&D total for 1979 will not vary by more than 5 percent from that proposed in the budget. The final total will, however, be *higher* than that originally requested by the President for 1979, as was the case for the 1977 and 1978 totals.

In the three most recent budgets—1977, 1978, and 1979—certain patterns have been repeated. The administration has planned either for a decrease—or a very slight increase—in R&D support for HEW (NIH) over the previous year, and the request level has later been substantially raised by the Congress so that for each of these years R&D support for HEW has been well ahead of inflation. Also, the levels requested for DOE (formerly ERDA) have later been substantially raised by the Congress. In each of these years, however, the amount requested for NSF has been reduced by the Congress, although not substantially. The amounts requested for USDA have been increased by the Congress. The patterns for DOD and NASA have varied.

Most Federal agencies supporting R&D programs reflected increases in those programs in 1977 and again in 1978. In 1977 the large appropriations for NIH and DOE produced an actual-year Federal R&D total higher than that originally proposed by the President. In 1978 despite the fact that DOD reflected a sizable decrease the increases for most other agencies had the effect of producing a slight increase over the original requested level. In 1979, again, all indications point to a final overall level higher than that originally proposed.

Share of Budget

Since 1965, when the share of R&D and R&D plant outlays in the total Federal budget reached a high point of 12.6 percent, the share has declined. Since 1976 this portion of the budget has been approximately 5.7 percent. Even though R&D and R&D plant outlays have been rising in recent years, the growth of other Federal programs, especially those under permanent budget authority, has been more rapid.

Another measure of Government science programs is the ratio of R&D and R&D plant outlays to the relatively controllable, or discretionary, portion of the budget, of which they are a part. This

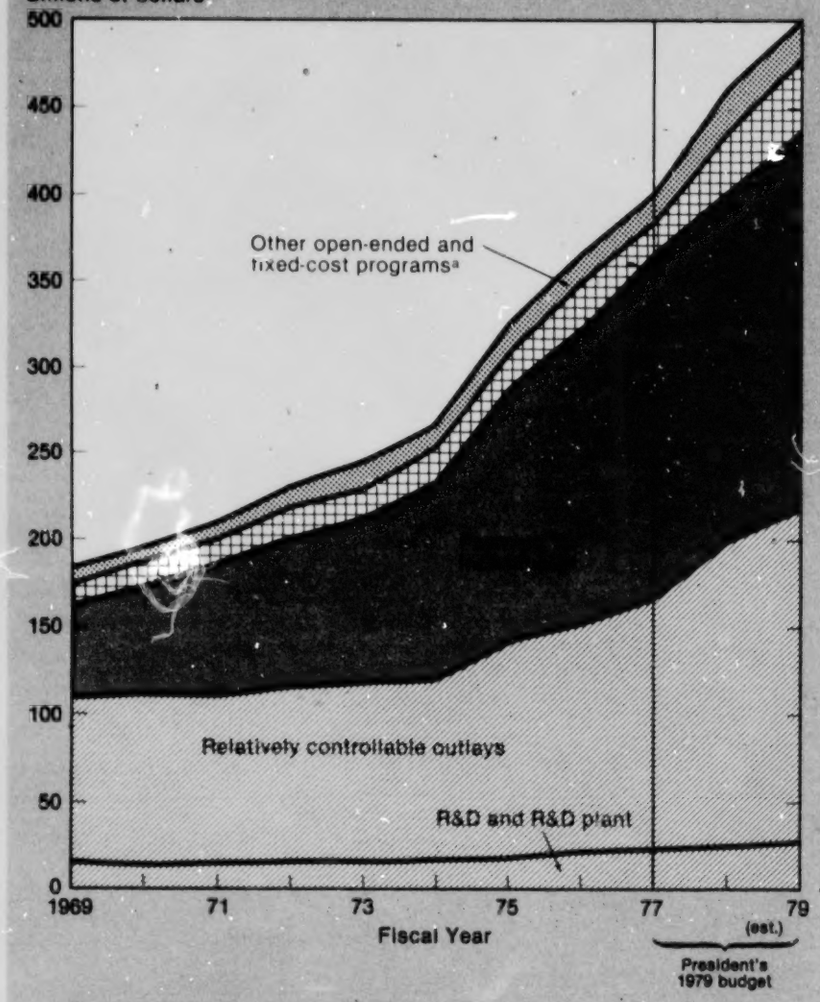
Federal overall budget outlays and R&D obligations and outlays: FY 1940-79

[Dollars in millions]

Fiscal year	Total budget outlays[1]	Research, development and R&D plant		R&D & R&D plant outlays as percent of total budget outlays
		Obligations	Outlays	
1940	$ 9,589	(2)	$ 74	0.8
1941	13,980	(2)	198	1.4
1942	34,500	(2)	280	.8
1943	78,909	(2)	602	.8
1944	93,956	(2)	1,377	1.5
1945	95,184	(2)	1,591	1.7
1946	61,736	(2)	918	1.5
1947	36,931	$ 691	900	2.4
1948	36,493	868	855	2.3
1949	40,570	1,105	1,082	2.7
1950	43,147	1,175	1,083	2.5
1951	45,797	1,812	1,301	2.8
1952	67,962	2,195	1,816	2.7
1953	76,789	[3]3,361	[3]3,101	4.0
1954	70,890	3,039	3,148	4.4
1955	68,509	2,745	3,308	4.8
1956	70,460	3,267	3,446	4.9
1957	76,741	4,389	4,462	5.8
1958	82,575	4,906	4,991	6.0
1959	92,104	7,123	5,806	6.3
1960	92,223	8,080	7,744	8.4
1961	97,795	9,607	9,287	9.5
1962	106,813	11,069	10,387	9.7
1963	111,311	13,663	12,012	10.8
1964	118,584	15,324	14,707	12.4
1965	118,430	15,746	14,889	12.6
1966	134,652	16,179	16,018	11.9
1967	158,254	17,149	16,859	10.7
1968	178,833	16,525	17,049	9.5
1969	184,548	16,310	16,348	8.9
1970	196,588	15,865	15,736	8.0
1971	211,425	16,156	15,973	7.6
1972	232,021	17,100	16,729	7.2
1973	247,074	17,574	17,489	7.1
1974	269,620	18,181	18,302	6.8
1975	326,185	19,864	19,556	6.0
1976	366,439	21,626	21,031	5.8
1977	402,725	25,362	23,391	5.8
1978 (est.)	[4]462,234	28,087	26,148	5.7
1979 (est.)	[4]500,174	29,320	28,146	5.6

[1]Outlays include expenditures plus net lending. Data through fiscal year 1953 are in terms of the "Consolidated Cash Statement," and data beginning with fiscal year 1954 are in terms of the "Unified Budget." [2]Not available. [3]Beginning in fiscal year 1953 amounts for both obligations and outlays include pay and allowance of military personnel in research and development. [4]These estimates are based on amounts shown in *The Budget, 1979*. SOURCES: Office of Management and Budget and Bureau of the Budget, *The Budget of the United States Government, Fiscal Years 1940 through 1979*; National Science Foundation annual surveys of R&D programs of Federal agencies.

Federal budget outlays by relatively controllable and uncontrollable components



[a]General revenue sharing, farm price supports (CCC) and other open-ended and fixed cost programs.

[b]Social insurance, housing payments and public assistance minus undistributed employer share and employee retirement.

SOURCES: Office of Management and Budget; National Science Foundation

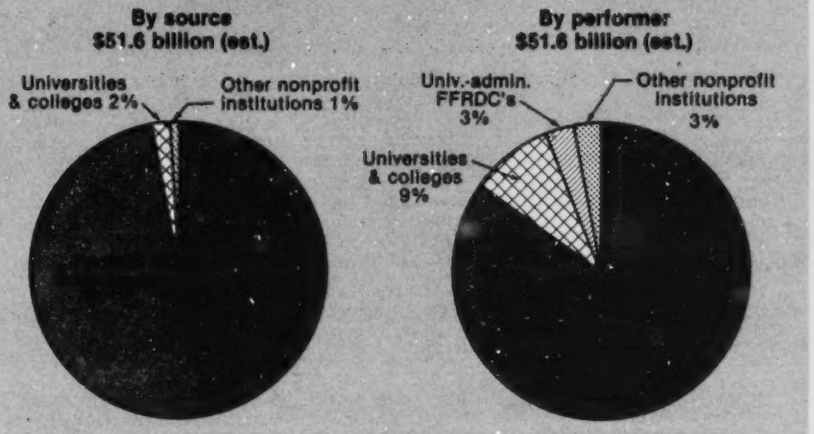
portion of the budget is subject to annual authorization and appropriation actions as distinct from the relatively uncontrollable area where the growth of fixed cost and open-ended programs[3] cannot be regulated except by changes in existing substantive law. R&D and R&D plant outlays as a share of the controllable part of the budget have moved from 14.6 percent in 1969 to an estimated 12.8 percent in 1979. When final data are obtained, the 1979 share may be higher.

Relationship to National R&D Total

As a provider of national R&D support the Federal Government has played the leading role. The Federal portion of the national total, however, has been slowly declining for a number of years as space efforts toward a manned lunar landing tapered off in the late sixties and early seventies and defense R&D funding remained almost level; at the same time R&D expenditures by industrial firms showed continuing growth. Not until 1975 did Federal R&D expenditures begin to show significant annual increases, whereas relative annual increases on the part of industry were substantial in most years after

[3] Social security, medical insurance, veterans benefits, public assistance, interest, and miscellaneous other programs. See the *Budget of the United States Government, Fiscal Year 1979*, table 14, (Washington, D.C.: Supt. of Documents, U.S. Government Printing Office), pp. 470-71.

National R&D expenditures: 1979



SOURCE: National Science Foundation

1971. Thus, in 1979 Federal agencies will account for almost 50 percent of national R&D expenditures, and industry will account for an estimated 47 percent. These ratios contrast with 58 percent for the Federal share and 39 percent for the industry share in 1969.[4]

When considering R&D performance, however, the roles played by Federal agencies and industry are far different. In 1979 industry is expected to account for 72 percent of the entire R&D effort carried out in the United States, much of this effort supported by Federal agencies and concentrated in the development end of the R&D spectrum. Federal agencies on their own account are expected to perform only 13 percent of the national R&D total. Universities and colleges will perform an estimated 9 percent and their associated FFRDC's[5] another 3 percent. The respective performance shares of all these sectors were almost identical in 1969.

Relationship to GNP

The share of the GNP that is represented by R&D activities is one indicator of the relative national priority given to R&D investment over given periods. It must be realized, however, that this indicator does not provide any information on the quality, value, or ultimate contribution of the R&D undertakings funded.

Between 1969 and 1979 the ratio of *national* R&D expenditures to GNP has dropped steadily, from 2.7 percent to an estimated 2.2 percent. Until 1975 the declines or slow growth rates in annual Federal R&D support were influential in retarding the growth of the national R&D effort. Since then both Government and industry have expanded R&D support in real terms, but, even so, the growth of GNP has been greater.

The effects of the recent spurt in *Federal* R&D investment are apparent in the trend of ratios of Federal R&D and R&D plant outlays to GNP (adjusted to a fiscal year basis). The ratio dropped steadily from 1.8 percent in 1969 to 1.3 percent in 1975 and 1976. The years 1977 and 1978 were both significant growth years for Federal R&D outlays, and the ratio did not drop but remained at 1.3 percent. It was expected to be 1.2 percent in 1979 based on the budget request, but later congressional actions now make likely a 1.3-percent ratio.

[4] See National Science Foundation, *National Patterns of R&D Resources: Funds & Personnel in the United States, 1953-1978—79* (NSF 78-313) (Washington, D.C.: Supt. of Documents, U.S. Government Printing Office, 1978).

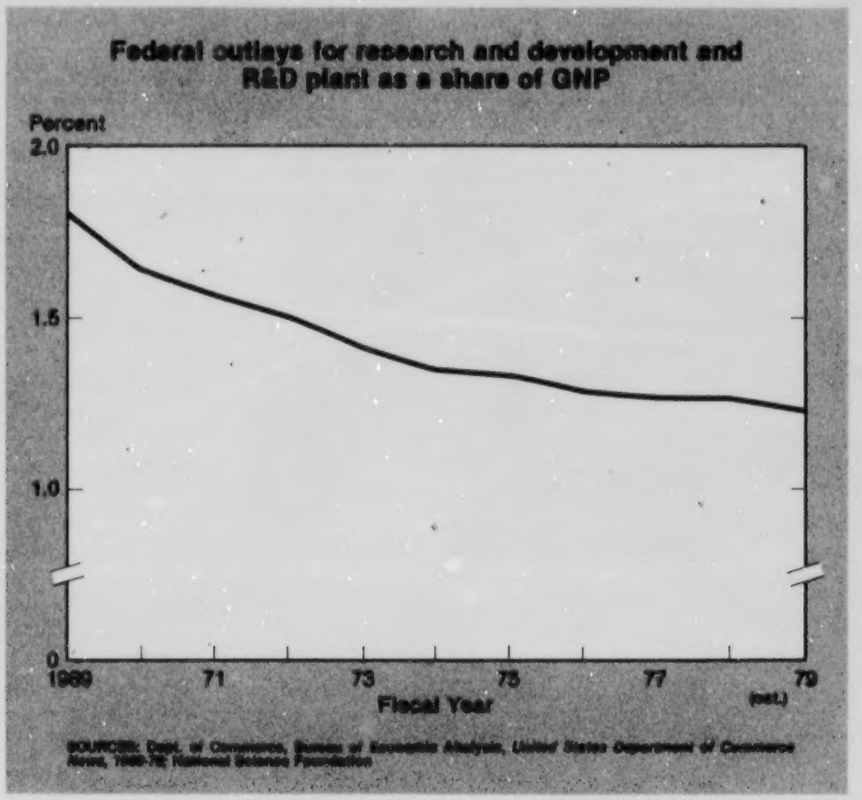
[5] Federally funded research and development centers.

Approximately one-half of Federal R&D support is directed to defense-related activities and more than one-tenth to space-related efforts. The results of such activities are difficult to measure by the kind of market analysis that is applicable to commercial R&D investment, as are the results of most other federally sponsored R&D efforts in health, environment, or other areas. Yet estimates have been made that Federal R&D investment has a highly leveraged effect on the economy, adding a large increment to GNP in the long run.[6]

Character of Work

In the 1969-78 period the most rapid rate of growth for the period as a whole was sustained by applied research, followed by basic research and development, in that order. The special emphasis on basic

[6] Chase Econometric Associates, Inc., *The Economic Impact of NASA R&D Spending* by Michael K. Evans. Bala Cynwyd, Pa., April 1976.



research in the 1977 and 1978 budgets had an effect on raising the growth rate, but in constant dollars the basic research level in 1978 was still only 5 percent higher than in 1969, whereas the applied research level was 26 percent higher.[7] Since 1976, however, far more rapid growth has occurred in basic research than in applied research funding. Thus, basic research obligations of $3.6 billion in the 1979 budget were an estimated 22 percent higher than in 1976 in real terms, whereas applied research obligations, at $6.8 billion, were only 2 percent higher.[8]

Development obligations scarcely rose at all in the early seventies, a period of decline for NASA programs and of no significant growth in DOD programs. These agencies have, since the early sixties, provided the preponderance of support to Federal development. In 1975 development funding rose significantly for the first time in eight years, spurred by added investment by DOD and DOE, especially the latter agency. Thereafter, steady increases have been shown for DOD, and steady but relatively smaller increases for NASA.

The 1979 budget proposals included $17.5 billion for all Federal development, a record high, even though DOE development obligations were below the 1978 level. Subsequent congressional actions raised the DOD, NASA, and DOE levels, but even with these increases the 1979 development total was 11 percent below that of 1969 in constant dollars. Like basic research, the main growth for development has been in recent years; between 1975 and 1979 funding has increased more than 15 percent in real terms.

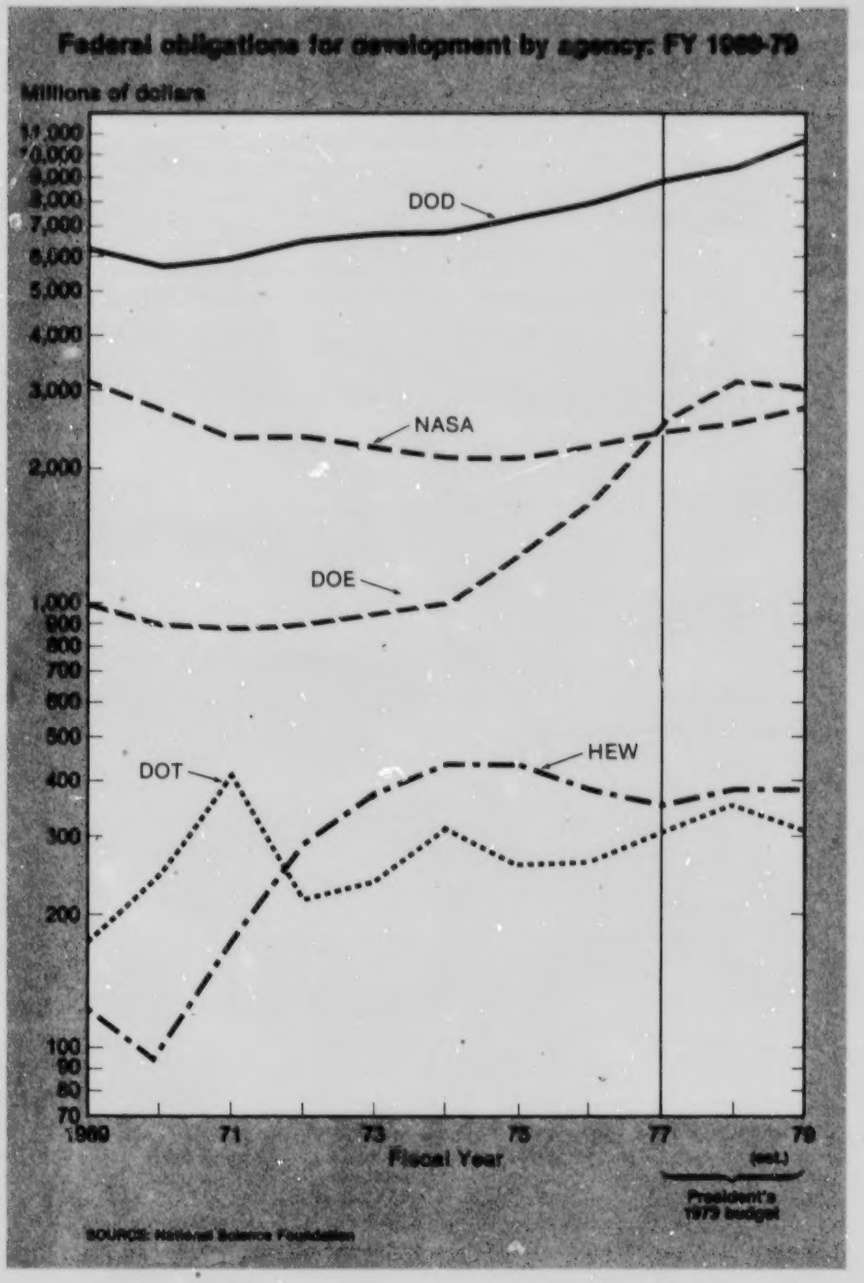
Development still accounts for more than three-fifths of all Federal R&D obligations—an estimated 63 percent in 1979. Applied research comprises an estimated 24 percent and basic research, an estimated 13 percent. The applied research share has fallen slightly in recent years and the development share has risen slightly.

Performers

In 1979 an estimated $21.0 billion of the Federal R&D total was expected to be directed to extramural performers and an estimated $6.9 billion to be performed intramurally (including actual R&D work

[7] The next NSF report on Federal R&D funding which will be based on a survey of the 1980 budget, will reflect higher Federal amounts for basic research and lower amounts for applied research than in previous surveys as a result of a reclassification of some research projects by the National Institutes of Health (HEW) and the Air Force. These data will be adjusted for prior years. Preliminary estimates for this new data series indicate a real increase of 8 percent in basic research funding between 1969 and 1978 and a real increase of 27 percent in applied research funding.

[8] For a fuller treatment of trends in basic research and applied research support, see section 2 of this report, Research Perspectives.



and administration of R&D activities). Three-fourths of the Federal R&D effort is currently carried out in the private sector under grant or contract.

Between 1969 and 1979 the most significant shifts in distribution of the Federal R&D "work load" have been a decline in the share, although not in the dollar amount, of the funds directed to industry, and a rise in the share, as well as the dollar amount, of funds directed to universities and colleges. In 1969 the share of industry (including FFRDC's) was 58 percent compared with an estimated 52 percent in 1979. The respective university-and-college shares are 10 percent versus 13 percent for these years, while university-administered FFRDC's accounted for another 5 percent in both 1969 and 1979.

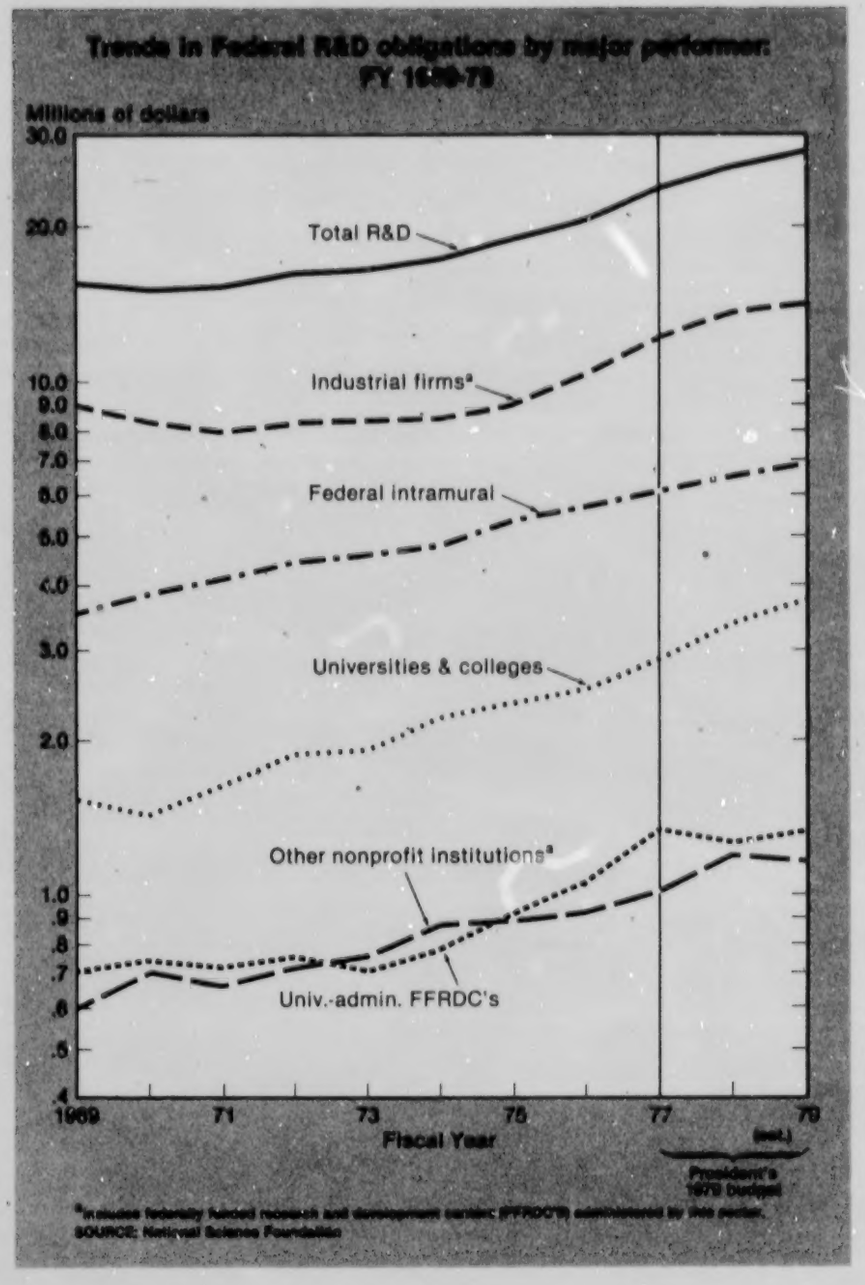
Between 1969 and 1974 Federal research support grew steadily while development support actually declined. From 1974 to 1979, however, the rates of growth for these two components have been nearly identical. Research is chiefly performed in Federal laboratories and in universities, whereas development is chiefly performed by industry. Consequently, the first half of the seventies witnessed an almost steadily rising share for academic R&D performance and a steadily declining share for industry R&D performance. Since that time the growth in DOD, NASA, and DOE programs has produced a

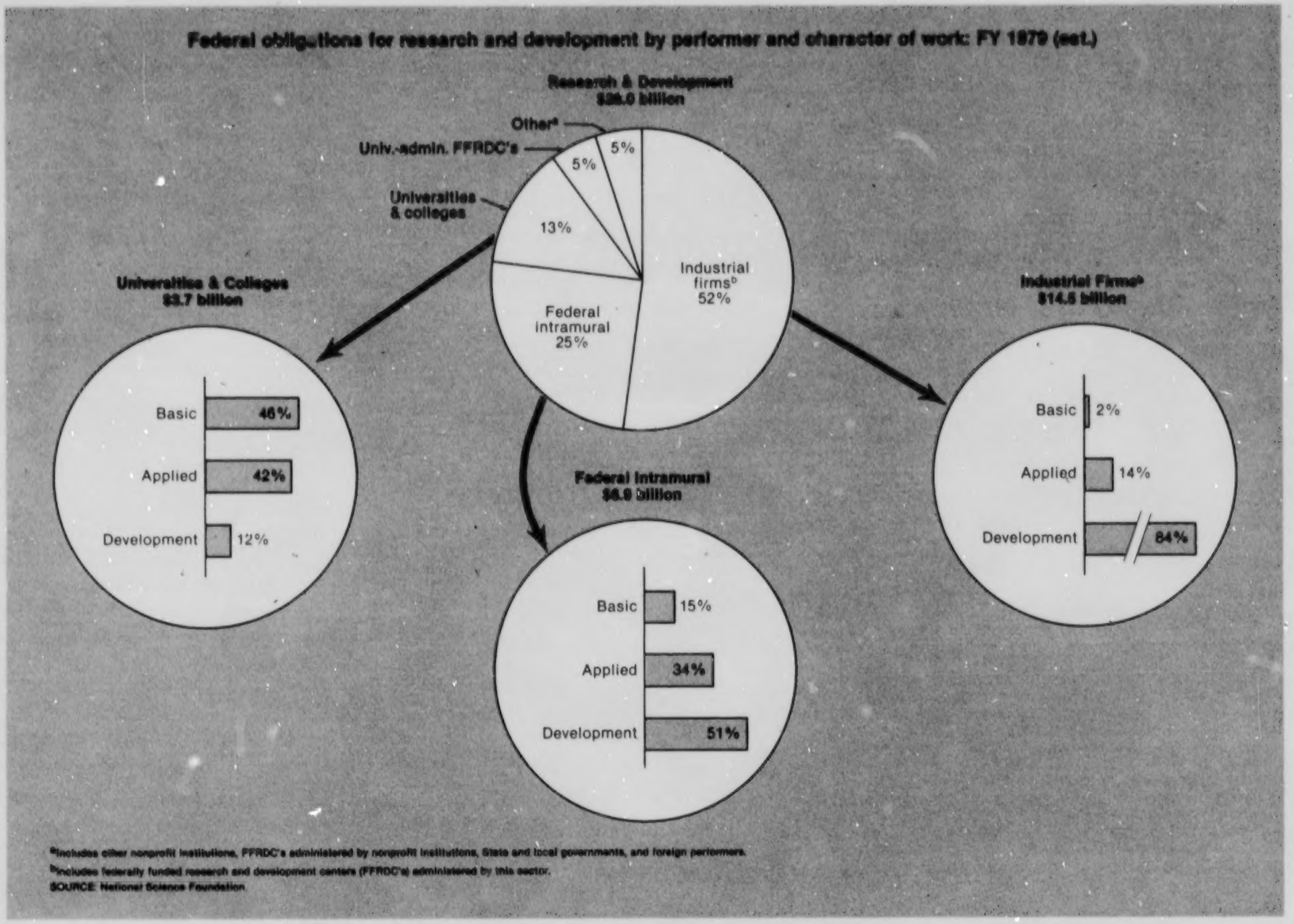
Federal obligations for research and development by performer: FY 1969 and FY 1977-79

[Dollars in millions]

Performer	Actual		Estimates	
	1969	1977	1978	1979
Total	$15,641	$23,929	$26,419	$27,972
Federal intramural	3,503	6,142	6,565	6,941
Industrial firms	8,704	11,125	12,432	13,315
FFRDC's' administered by industrial firms	427	1,113	1,180	1,202
Universities and colleges	1,529	2,886	3,408	3,665
FFRDC's' administered by universities	722	1,327	1,283	1,326
Other nonprofit institutions	364	782	893	888
FFRDC's' administered by nonprofit insitutions	241	264	306	290
State and local governments	100	203	229	222
Foreign	51	88	124	124

Federally funded research and development centers
SOURCE: National Science Foundation




Federal obligations for research and development by performer and character of work: FY 1979 (est.)
Research & Development
$26.0 billion
Other[a]
Univ.-admin. FFRDC's
Universities & colleges
5%
5%
13%
Industrial firms[b] 52%
Federal intramural 25%
Universities & Colleges
$3.7 billion
Basic 46%
Applied 42%
Development 12%
Federal intramural
$6.5 billion
Basic 15%
Applied 34%
Development 51%
Industrial Firms[b]
$14.5 billion
Basic 2%
Applied 14%
Development 84%
[a]Includes other nonprofit institutions, FFRDC's administered by nonprofit institutions, State and local governments, and foreign performers.
[b]Includes federally funded research and development centers (FFRDC's) administered by this sector.
SOURCE: National Science Foundation

flow of funds into development and into industry with the result that the industry share of the Federal R&D total has been rising. From 1974 until 1977 the university-and-college share fell, but since 1978 it has been rising as increased support has been given to basic research.

In recent years intramural R&D activities have comprised a declining share of the Federal R&D total. Between 1969 and 1975 R&D obligations for intramural activities rose continuously and the share of intramural work within the Federal R&D total increased from 22 percent to 28 percent. Since then, although funding has continued to rise, the share has fallen. The rapid growth of DOE industry-performed development programs and a DOD policy of encouraging defense laboratories to place more research projects with extramural performers have been important factors in reducing the intramural share to the present level of 25 percent.

Other nonprofit institutions, including associated FFRDC's, have shown significant growth in funding since 1975, mostly stemming from HEW (NIH) and DOD programs. The share of the Federal R&D total is an estimated 4 percent in 1979.

Section 2. RESEARCH PERSPECTIVES

Federal R&D funding is frequently analyzed by character of work—basic research, applied research, or development. Each of these areas of activity is distinguished by particular goals, and in each area there is a tendency to use the resources in certain performing sectors and to draw upon certain kinds of skills and capabilities. Since the two research components are similar to each other in many ways and significantly different from development, it is worthwhile to analyze aggregate Federal research support (basic and applied research combined) as separate from development. The development component of Federal R&D funding is two-thirds again as large as the research component and often consists of more highly structured activities since development involves the last step in the R&D process leading to the actual production of new materials, devices, systems, or methods. By contrast, research is likely to involve studies less structured or specific that are oriented toward obtaining a fuller knowledge of the properties, behavior, and relationships of natural and social phenomena. Such knowledge is required for a deeper understanding of the world we live in and is a prerequisite for practical applications.

Federal agencies support basic research and applied research with different objectives. In the case of basic research the objective is to gain fuller knowledge of the fundamental aspects of phenomena without specific applications in mind; in the case of applied research the objective is to gain knowledge or understanding for determining the means by which a recognized need may be met.

In the early seventies Federal sponsorship of research was more heavily focused on applied research, funding for which grew at a faster rate than for basic research. Starting with the 1977 budget, however, emphasis has been placed on basic research by two successive administrations. This recent emphasis has tended to divert attention from an examination of trends and activities in research as a whole even though the two phases of research are interrelated. This section is focused on Federal research as an entity although a separate discussion of basic research and applied research is included, where necessary.

Within all national research expenditures Federal research expenditures now account for approximately 56 percent. The share was as high as 63 percent in 1965 and since then has tended to diminish, although Federal funding is still the dominant force in national research support with industry following.

Long-Term Trends

In the past 25 years Federal research funding has moved through four broad cycles. The first, from 1956[9] through 1963, was one of rapid growth when DOD missiles programs, NIH biomedical research programs, and NASA space research programs were building strongly. This period covered the Cold War and the response to the U.S.S.R. Sputnik satellite, launched in 1957. Annual funding increases of 20 percent to 30 percent prevailed in most years of this period, reflecting a steep upward trend from relatively low levels.

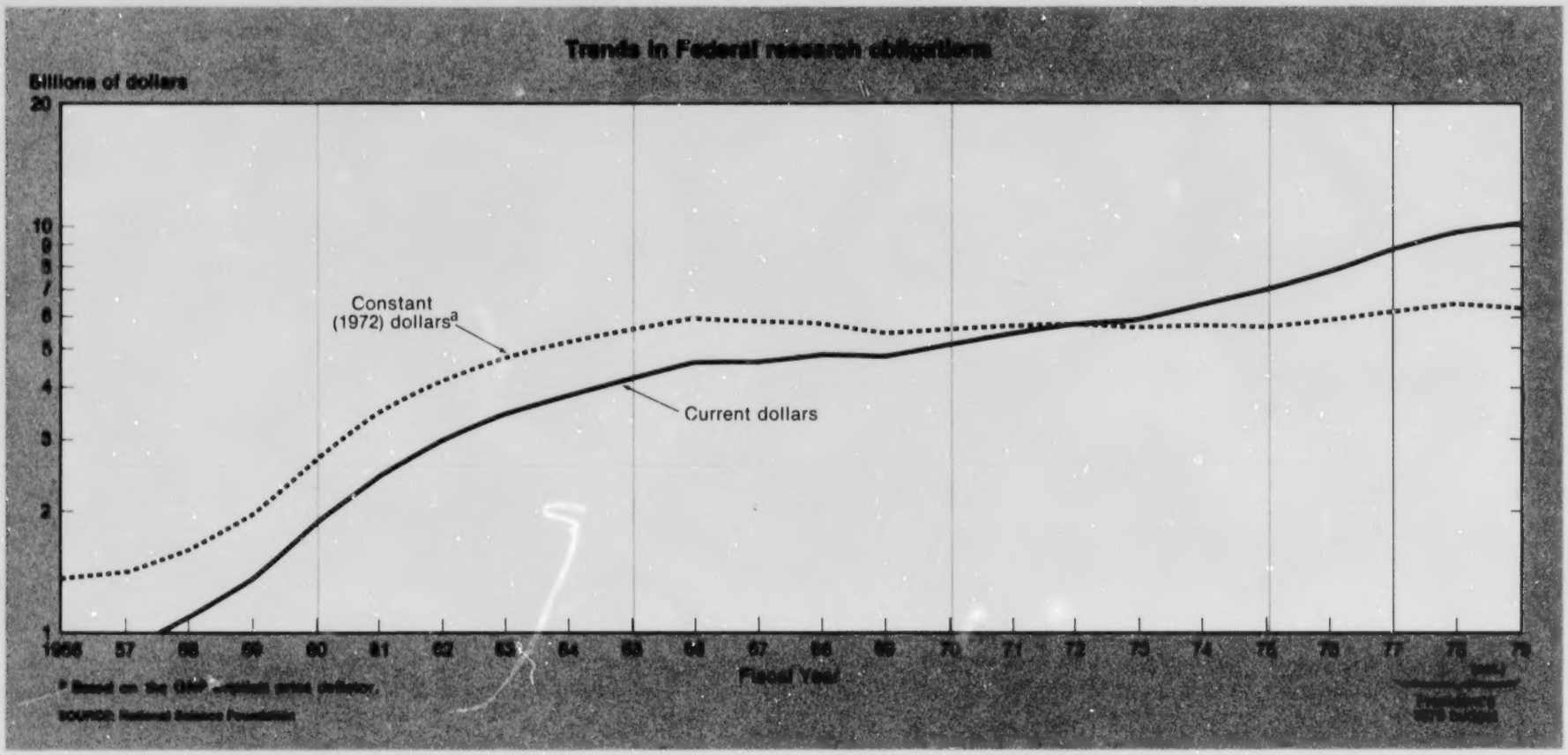
The second cycle, from 1963 to 1966, represented a broader program mix with increases in the Federal research total of approximately 10 percent annually.[10] Gains had slowed for DOD, HEW, and NASA, the three leading support agencies, as their programs reached later stages of growth. In the case of DOD and NASA many of the earlier research efforts had progressed into the development stage, especially for the NASA manned lunar landing effort. For the Atomic Energy Commission (AEC) and USDA, however, rates of research funding rose. During this period NSF research support, which gained momentum as a result of Sputnik, approached that of USDA for the first time. By 1966 Federal research obligations had reached a record high in terms of constant dollars that was not to be matched for a number of years.

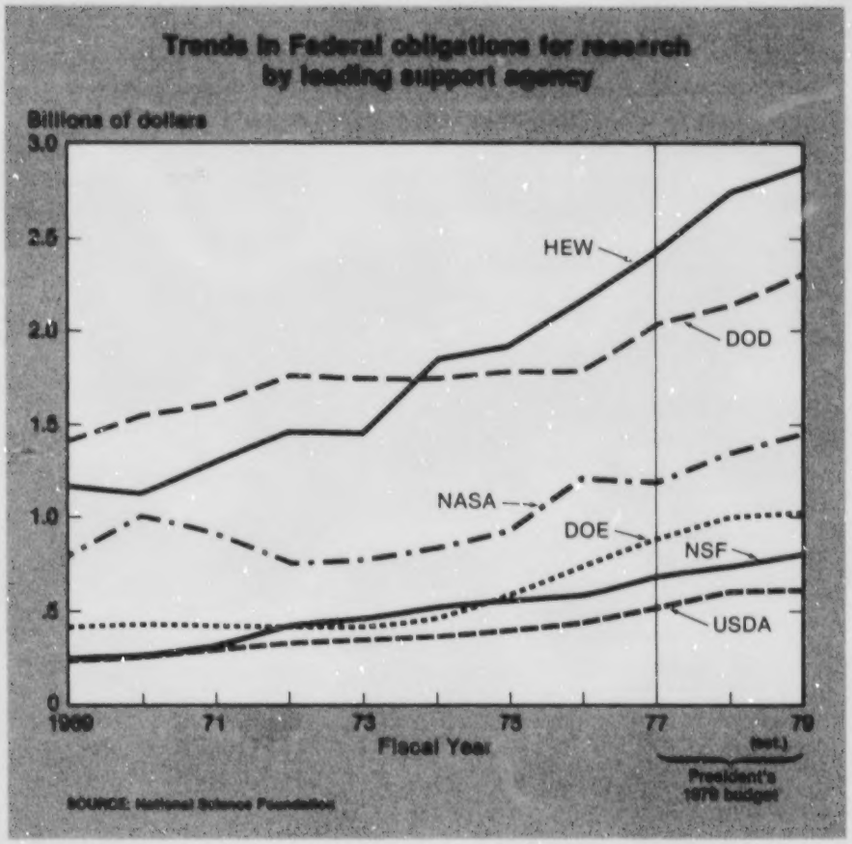
[9] Fiscal year 1956 is the first year for which research data (both basic and applied) were reported by Federal agencies to the *Federal Funds* survey.

[10] Levels reflect data for NASA research support in the years 1959-62 and 1964-66 that have been estimated by NSF to reflect a shift in classification of some programs from research to development.

The third cycle, from 1966 through 1973, reflected almost a standstill in the overall effort. This was the period that included the buildup and resulting turmoil of the Viet Nam war. The average annual rate of growth for total Federal research funding was only 3.5 percent, representing a slight decline in real terms. Lack of growth for the larger agencies held down growth for the total, although gains occurred for agency sponsors of the next order of rank. DOD, the leading support agency at that time, reflected no increase in this period when overall R&D funding for this agency was showing little growth. DOD research support suffered partly as a result of the war-induced public feeling that the military should become disengaged from sponsorship of university research, which was mostly basic in character, but to a larger extent as a result of lessened support for all DOD research (85 percent of DOD research is applied).

The increases for HEW, the second support agency, were moderate since this period was not propitious for large, new health initiatives. NASA's research obligations traced an absolute decline after 1970 as the Apollo mission was completed. The research obligations of AEC showed virtually no growth. The result was that NSF research support, which had been rising rapidly, partly through the assumption of some DOD research projects, overtook the AEC research total for the first time in 1972. In the meantime USDA also underwent considerable research expansion.





After 1973 a fourth cycle was set in motion that was characterized by a resurgence of growth for all the leading support agencies. By this time the erosion of real support for research in defense and space had become apparent, and a general belief had arisen that cancer and heart disease could be conquered, or at least much alleviated, through science. Added to this background was the Arab oil embargo in the fall of 1973, which soon resulted in a rapid increase in funds for energy research.

The average annual rate of increase in Federal research obligations from 1973 through 1977 was 10.6 percent in current dollars, or 2.3 percent in constant dollars. The earlier "real dollar" high (1966) was surpassed in 1977, and a real gain of 4 percent was registered in 1978. The chief areas of growth during this period were biomedical research, especially that devoted to cancer and heart disease investigations, energy-related research, space-related research, and defense-related research. Public endorsement of the role of science in solving national problems had been renewed.

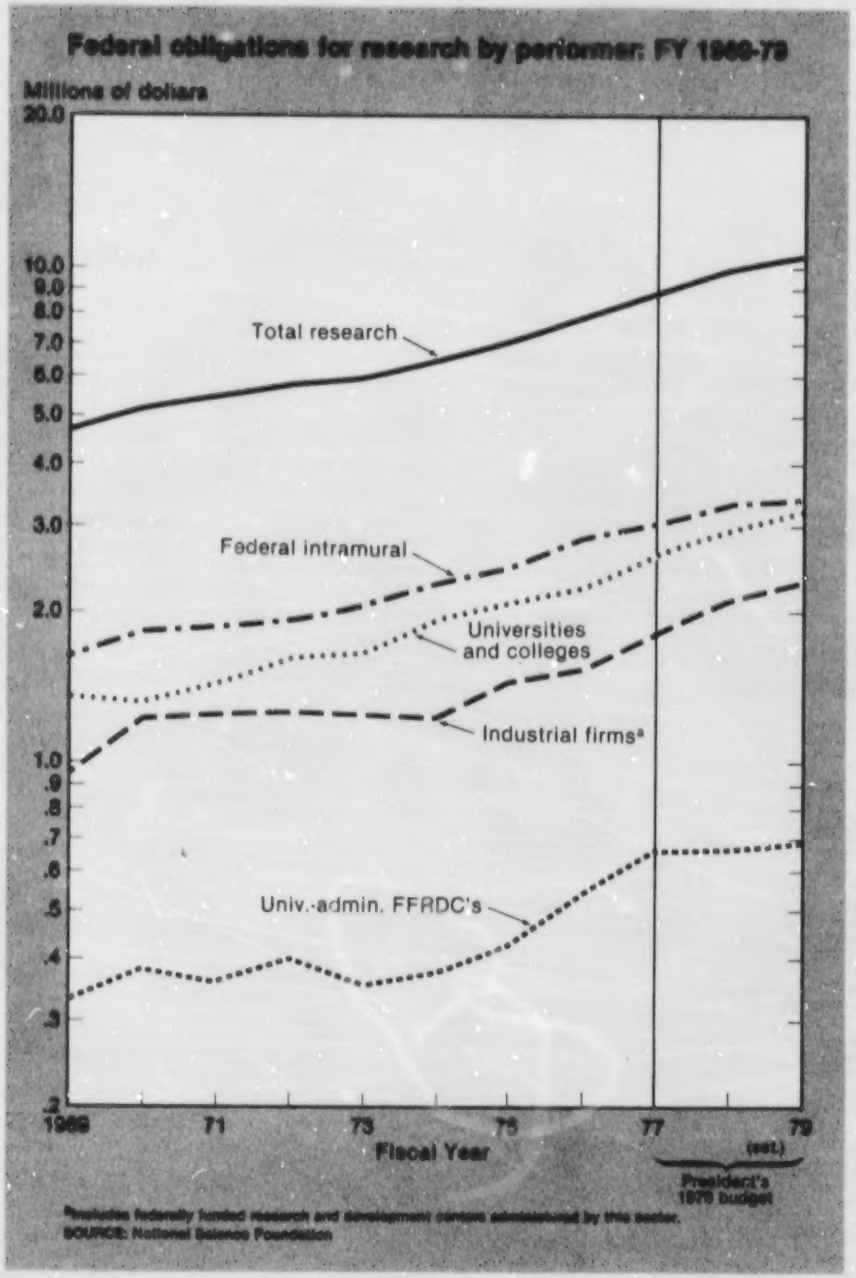
In the President's 1979 budget, however, a note of austerity was introduced. The total of $10,483 million in proposed research obligations was only 6 percent higher than the 1978 total, or just enough to match the anticipated inflation, which has since been revised upward. Subsequent to the budget message, Congress added considerable funds for biomedical research and increased agriculture research and energy research over the budget proposals. Thus, even though Congress eliminated some programs and cut others, the final increase in Federal research obligations for 1979 is likely to be on the order of 12 percent, or sufficient to meet inflation.

Performers

The chief performance sector for Federal research has nearly always been the Federal sector. Intramural funding, as reported to NSF surveys, it should be noted, includes the costs of administering both intramural and extramural research along with actual in-house research performance. In the past decade the intramural share of the aggregate research activities of Federal agencies has been 35 percent in most years with some decline in share in the 1977-79 period as the availability of Federal basic research funds has been increased and these have been mostly directed to extramural performers. Applied research makes up approximately two-thirds of all Federal research, and the largest portion of Federal applied work is accomplished in-house.

The chief Federal research laboratories and test facilities are those of DOD, NASA, and HEW (chiefly NIH). When basic research alone is considered, the leading intramural support centers are found to be those of NASA, HEW (NIH), USDA (AR), Interior (Geological Survey), and DOD, in that order.

Among research performers, the university-and-college sector has remained constantly in second place since 1969. In earlier years when NASA manned space programs were building rapidly, the industrial sector was in the lead in Federal research performance. Significantly, the university-and-college share has tended to grow in the past decade, notably after 1970, when it was 25 percent, to an estimated 31 percent in 1979. Somewhat more of the research support to universities—as



much as 55 percent in 1973 and as little as 50 percent in 1977—has been represented by projects that the agencies reported as basic research.

The point should be stressed that basic research and applied research data, as reported to NSF by Federal agencies, represent the agencies' categorization of research projects. Thus, obligations to universities that agencies report as applied research may be reported in NSF *performer* surveys of R&D expenditures as basic research since the reporting staff in university offices of the dean or budget manager usually tend to view university research activities as basic by definition.[11] Consequently, when analyzing impacts on the university-and-college sector, it is more useful to examine total research data and total R&D data reported by Federal agencies than to examine basic research data alone.

Industrial firms[12] have accounted for 20 percent to 22 percent of all federally supported research in the 1969-79 period, compared with considerably higher shares in the earlier sixties. Almost 90 percent of this research is considered applied. Almost one-half of this research is supported by DOD and one-fourth by NASA. One-tenth of the support at present is provided by DOE.

FFRDC's administered by universities have accounted for approximately 7 percent of the Federal research total in the past decade. Almost three-fourths of their support has been provided by DOE and its predecessor agencies.

Nonprofit institutions have performed 6 percent of the Federal research total. These have been most heavily supported by HEW.

[11] In 1977 universities and colleges reported to NSF 77 percent of their federally sponsored research as basic research while for the same year Federal agencies reported to NSF 50 percent of their research obligations to universities as basic research.

[12] Including FFRDC's administered by this sector.

Universities and Colleges

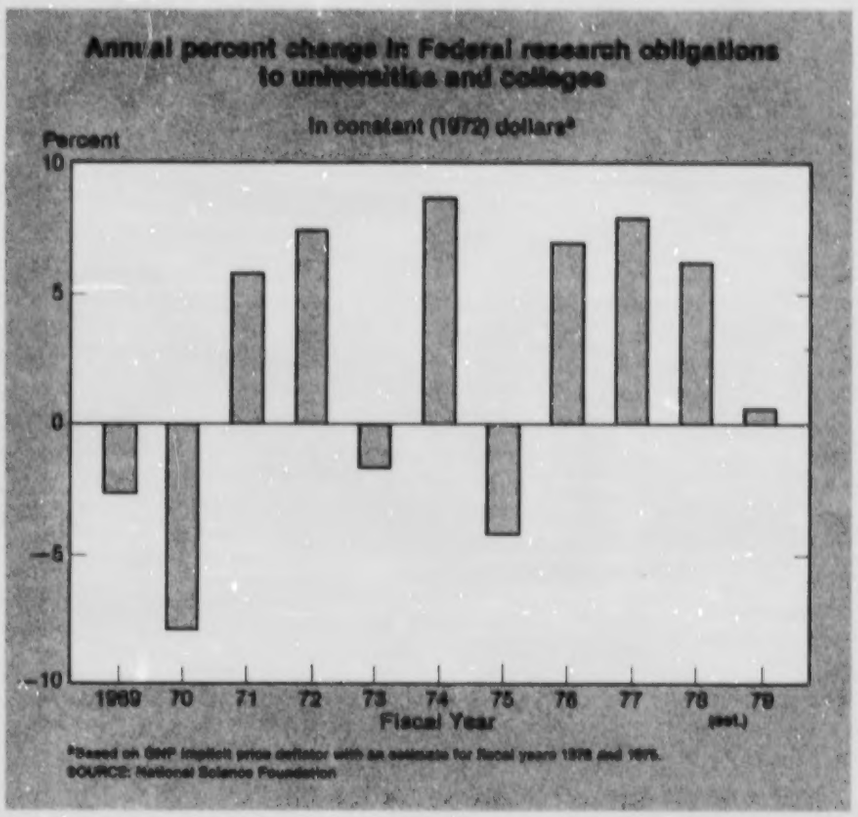
Federal research support to universities and colleges is an area of particular concern in that many institutions of higher learning have become financially dependent on Federal research grants in the past three decades, as an aid in the education of graduate students, support of science research staff, and a source of indirect payments for a portion of overhead costs. Graduate students in the sciences develop knowledge and skills in their specialities through the performance of research under the guidance of men and women advanced in their fields.

The groundwork for Federal use of universities and colleges for essential research was put in place during World War II and in the years immediately thereafter. Policies were then established for agency relationships with universities in the use and administration of the research grant mechanism. At present two-thirds of university and-college R&D funds are provided by the Federal Government.[13]

Data have been compiled by NSF on Federal R&D support to extramural performers only as far back as 1955. These data, however, show a steady rise year after year in the use of universities and colleges for R&D performance[14] until 1970 when the first and only decline in funding occurred. The effects of the war-induced inflation of that period were such that a real decline had begun in 1968 that continued through 1970; in subsequent years real support has fluctuated from one year to the next although the general trend has been a rising one.

The launching of the Sputnik satellite by the U.S.S.R. in 1957 stimulated a strong response in the form of accelerated R&D activities by Federal agencies of the United States. NASA was established in 1958 to pursue the Nation's exploration in space, and although several years passed before the NASA contribution to university-and-college support became noteworthy, the effect of the Russian achievement on DOD and NSF was immediate. The R&D support of the university sector by these agencies grew significantly and continuously. Not until 1967 did the funds directed by DOD and NASA to academia decline, although support from NSF continued to grow steadily. Meanwhile HEW, the second agency after DOD in R&D support to universities at the time of Sputnik, increased funding so rapidly that it became the chief agency in such support by 1960, a position it has maintained by an increasing margin ever since. The reasons for the growing leadership of HEW, however, were related to public faith in science as a source of solutions to national health and longevity rather than to competition with the Russians.

Research now accounts for approximately 9 out of 10 R&D dollars directed by Federal agencies to universities and colleges. Between 1969 and 1973 the average annual real growth in such research support was only 0.7 percent, whereas between 1973 and 1979 the average annual real growth rate has been an estimated 3.2 percent. In 1977 and 1978 research gains were especially high—8 percent and 6 percent for these respective years on a constant-dollar basis.



[13] See National Science Foundation, *Expenditures for Scientific Activities at Universities and Colleges, Fiscal Year 1977: Detailed Statistical Tables* (NSF 78-311) (Washington, D.C., 1979.)

[14] R&D data are used in this portion of the analysis since research data are available only as far back as 1963.

46

47

In the 1979 budget, by contrast, the total research support growth was an estimated 9 percent,[15] or less than 1 percent in real terms. The significant point is that each year since 1975 has witnessed real growth in Federal research support to universities and colleges. In fact, after a sharp decline in 1970 real growth has been shown in most years.

Relating to these data are other data that reveal a 3-percent annual increase in the employment of scientists and engineers at American universities and colleges in the 1975 to 1978 period.[16] These employment data, it should be noted, include other S/E personnel besides regular faculty where employment grows more slowly. They include part-time and temporary research staffs, adjunct and visiting professors, and others.

Behind the broad academic trends are agency participation and agency policies. A key fact of Federal research support to universities and colleges is the strong role of HEW, primarily NIH. Much of this support, however, is to medical schools in contrast to the distribution of broader university support by other agencies. In the past decade HEW has accounted each year for approximately one-half of the university-and-college research support: a low share of 47 percent in 1970, a high share of 54 percent in 1974, and a current share of 52 percent. Very rapid growth in research funding occurred in the early seventies as a reflection of the cancer and heart and lung initiatives. Since 1974 relatively rapid growth has continued; by 1978 and 1979 the growth was more a reflection of increases in research support for the health institutes other than cancer and heart and lung than for these institutes, although growth continued in all health areas.

HEW provides the outstanding example of the difficulties in analyzing research support to universities and colleges in terms of a sharp contrast between basic research and applied research. In the 1979 budget HEW (largely NIH) reported an estimated 61 percent of the research it sponsored at universities and colleges as applied research and 39 percent as basic research. Since NIH is now in the process of reclassifying a considerable number of its research projects, many of those formerly categorized as applied will be categorized as basic in the future, and prior-year data will be adjusted accordingly.

[15] The final effect of congressional appropriation actions is known at the present time in terms of R&D data only. As a result of congressional actions Federal R&D obligations to universities and colleges will rise an estimated 14 percent from 1978 to 1979; most of this change reflects research.

[16] See National Science Foundation, *Human Resources for Scientific Activities at Universities and Colleges, January 1978, Detailed Statistical Tables* (NSF 78-318) Washington, D.C., 1979.)

Federal research obligations to universities and colleges by agency: FY 1968-79

[Dollars in millions]

Agency	1969	1970	1971	1972	1973	1974	1975	1976	1977	Estimated 1978	Estimated 1979
Total	$1,359	$1,320	$1,469	$1,650	$1,694	$1,984	$2,105	$2,268	$2,612	$2,963	$3,219
Department of Health, Education, and Welfare	659	622	698	806	802	1,062	1,078	1,198	1,357	1,548	1,649
National Science Foundation	208	223	254	346	370	369	420	429	505	548	601
Department of Defense	222	180	196	185	168	186	190	212	243	272	306
Department of Energy[2]	98	97	90	81	79	86	112	116	134	164	203
Department of Agriculture	61	65	72	87	94	94	108	119	139	173	192
National Aeronautics and Space Administration	61	65	70	48	80	85	91	98	105	114	114
Environmental Protection Agency	—	15	16	17	18	23	32	29	46	45	48
Other agencies	48	53	74	81	82	78	75	65	84	99	154

[1] Data are based on the President's 1979 budget to Congress.
[2] Prior to 1974 data for AEC were used, and from 1974 to 1976 data for ERDA were used.
SOURCE: National Science Foundation.

Therefore, the shares of basic research and applied research will be closer in size, and the NIH concept of the nature of the work it is sponsoring at universities will move closer to the university concept.

NSF has been the second largest funding agency for research support to universities and colleges since 1970, and the NSF share of all Federal support has tended to increase somewhat. In 1969 it was 15 percent, and in the period from 1976 through 1979 it has consistently been 19 percent. Thus, HEW and NSF together account for approximately 7 out of 10 federally provided research dollars for academic performance.

The role of NSF as a provider of basic research funding increased markedly from 1969 to 1973 as DOD basic research grants and contracts with universities and colleges declined in response to legislative mandates and as AEC (predecessor to DOE) followed suit, although not specifically directed to do so. Since 1972 the share of NSF within the Federal basic research total has ranged between 32 percent and the 36 percent shown in 1977 when a substantial increase in basic research support occurred as part of administration policy. NSF applied research support to universities rose almost steadily from 1969 to 1974, influenced almost entirely by the Research Applied to National Needs (RANN) program; NSF applied research programs never represented more than 6 percent of the total Federal applied research support to universities.

In the early sixties DOD contributed twice as much research support as NSF to universities and colleges. By 1968, however, NSF was placing more funds with academia than DOD. The decline that set in in DOD support to universities after 1969 was a reflection of Viet Nam war antimilitary sentiments and the Mansfield Amendment.[17] DOD research support fell abruptly in 1970 and then fluctuated, reaching a low in 1973. Since then support to universities has shown a steady upward trend.

In 1979 the estimated shares of DOD in Federal research support to universities and colleges is 10 percent, compared with 16 percent in 1969. A policy was initiated by DOD in 1976 of building up technology base to maintain the technological lead of the Nation in defense areas. The recent more rapid rise in DOD research funding to universities and colleges reflects this policy.

DOE funding reflected a declining share of the Federal support total between 1969 and 1974. The agency's research funds to academia fell year after year, only beginning to rise in 1974 and then increasing very sharply in the 1978 and 1979 budgets.[18] Recent policy decisions have been made to increase basic research and the participatory role of the university sector in the agency's programs.

In 1969 USDA and NASA each represented 5 percent of the total Federal research support to universities and colleges. By 1979 the USDA share had risen to 6 percent and the NASA share fallen to 4 percent. Since 1974 USDA research funding has grown markedly as more funds have been made available to Cooperative Research; some of this increase is attributable to the competitive research grants program in basic research initiated in 1978.

Fields of Science

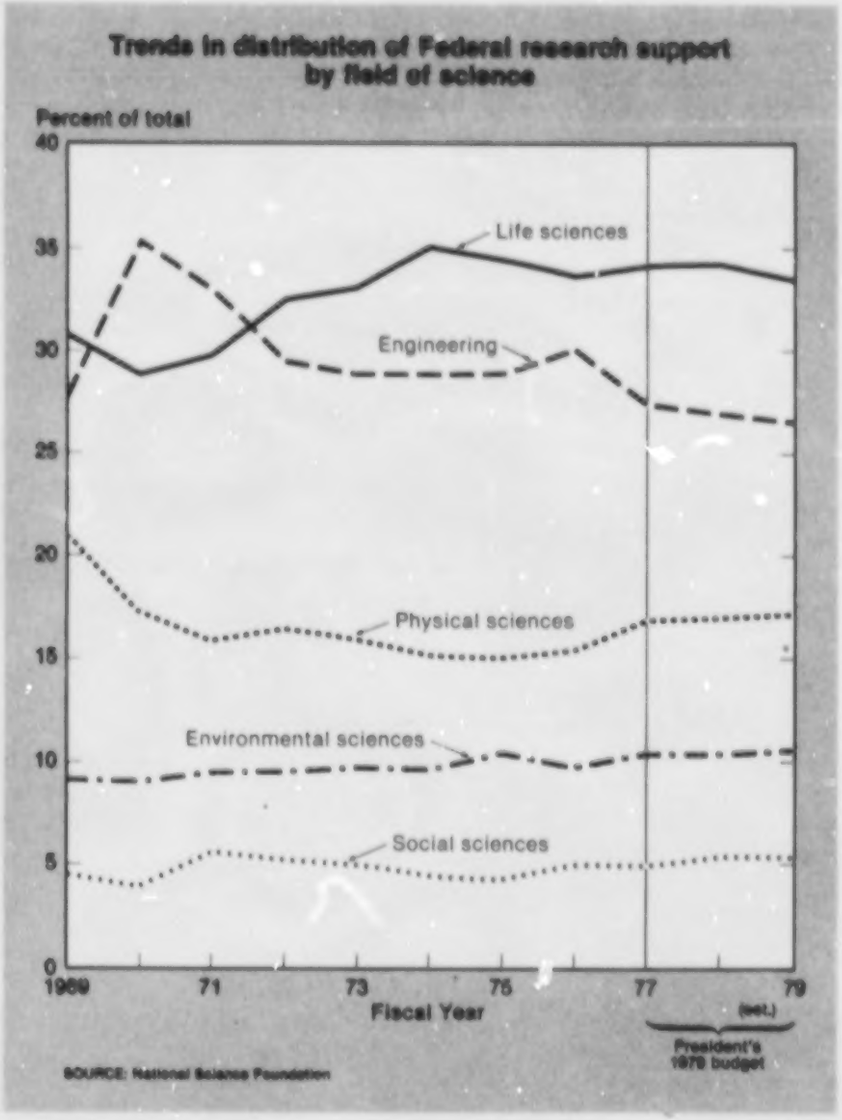
In the 1969-79 decade the life sciences have represented the most heavily funded field of research in most years, and they have also been one of the most rapidly growing. They make up 34 percent of all Federal research at the present time. The growth of the life sciences has been closely tied to HEW (NIH) programs. An estimated reduction in the growth rate in 1979 was largely based on slower growth anticipated in the budget in NIH, USDA, and DOE research programs—all of which, however, received increases from Congress over the requested amounts.

Engineering, second most active research field since 1972, showed moderate growth in the 1969-78 period and slight growth projected for 1979. Currently engineering accounts for 27 percent of the Federal research total. Approximately one-half of the support is derived from DOD, and one-fourth from NASA. In recent years DOE and the Nuclear Regulatory Commission have accounted for increasing shares of the total; their combined share in 1979 is an estimated 11 percent compared with less than 3 percent for the predecessor agency, AEC, in 1969.

The physical sciences (astronomy, chemistry, physics), primarily supported by DOE, DOD, NASA, and NSF, declined both in funding and relative importance at the start of the seventies but began to grow in amounts invested from 1974 onward as research programs of DOD and DOE were expanded. Growth in the 1979 budget reflected continued increases in programs of these agencies as well as in

[17] See pp. 23 for a discussion of the Mansfield Amendment and its effects.

[18] DOE is by far the leading agency sponsor of university-administered FFRDC's. When university research support and university-administered FFRDC research support are combined, the increases for 1978 and 1979 are not nearly as sharp, an indication that DOE policy appears to be to increase funds to universities proper.



programs of NASA and NSF. Thus, the physical sciences now make up 17 percent of the Federal research total compared with 14 percent in 1974 and 21 percent in 1969.

The environmental sciences (atmospheric, geological, oceanographic) showed one of the highest growth rates in research funding among all the major fields in the 1969-78 period. The same rate continued in the 1979 budget estimates with the result that the environmental sciences today comprise 11 percent of the research total. Programs of DOD, NASA, NSF, and EPA have made important contributions to the growth of this field. In the latest budget period (1977-79), however, the Department of the Interior reflects sharp growth, making this agency the third largest in support.

The social sciences showed the most rapid increase in Federal research funding for any field between 1969 and 1978, but a much more moderate increase was planned for 1979. These sciences account for 5 percent of all Federal research support at present. The chief support has come from HEW, primarily in interdisciplinary areas related to education and health care financing and delivery and in sociological studies related to mental health and drug abuse. USDA has been second in size of support, virtually all of it concentrated in economics

Federal obligations for research by major fields of science: fiscal years 1969-79

[Dollars in millions]

Field	Actual	Estimated			
	1969	1978[1]	Average annual rate of change 1969-78	1979[1]	Rate of change 1978-79
Total	$4,735.2	$9,857.5	+8.5	$10,482.7	+6.3
Life sciences	1,462.2	3,382.9	+9.8	3,506.9	+3.7
Engineering	1,326.4	2,665.0	+8.1	2,791.3	+4.7
Physical sciences	1,002.4	1,695.9	+6.0	1,818.7	+7.2
Environmental sciences	436.0	1,011.8	+9.8	1,109.5	+9.7
Social sciences	214.2	530.0	+10.6	556.9	+5.1
Mathematics and computer sciences	112.9	197.9	+6.4	230.3	16.4
Psychology	101.3	177.9	+6.5	200.3	+12.6
Other sciences	79.8	196.1	+10.5	268.7	+37.1

[1] Data are based on the President's 1979 budget to Congress

under CR and the Economics, Statistics, and Cooperatives Service (ESCS). NSF has been the third largest agency sponsor, mostly for interdisciplinary research project support.

It should be noted that when research is separated into basic and applied, the relationships change somewhat. Within basic research, the life sciences still predominate, and this field, the physical sciences, and the environmental sciences are the three leading fields. Engineering, fourth in importance, has a relatively small share. Within applied research the three leading fields are engineering, with more than one-third of the total; the life sciences, with just under one-third; and the physical sciences, with approximately one-tenth. The environmental sciences and social sciences are next in size of funding. The social sciences, however, are somewhat more concentrated in applied research, making up 6 percent of the Federal total.

Agency Programs, 1969-79

HEW is now the leading agency in Federal research sponsorship, and this has been the case since 1974 when HEW moved ahead of DOD in research funding. This situation compares with overall Federal R&D funding where DOD and NASA have been the leading support agencies for many years and where DOE was in third place in the 1979 budget and HEW in fourth position.

In the fifties and sixties DOD led all other agencies in research support. The largest efforts were represented by the Air Force and the Defense Agencies, within which the chief effort was contributed by the Defense Advanced Research Projects Agency. By 1974, however, the rapid expansion of NIH biomedical research had pushed HEW research support above the DOD levels, and HEW has continued since that time to be the leading agency research sponsor by a wide margin.

HEW Approximately four-fifths of the research conducted by HEW, either directly or by grant or contract, is carried out by NIH, and less than one-tenth is conducted by ADAMHA, the second largest subdivision to support research programs. Both of these HEW subdivisions concentrate in biomedical and health-related areas. Education research, which is conducted by the National Institute of Education and the Office of Education, amounts to 2 percent of all HEW research support at the present time.

In the past decade NIH has assumed an increasing share of all research supported by HEW. The eleven institutes within NIH range across the health research disciplines. The two concerned with cancer and heart and lung research have always been the largest, and their growth from 1971 through 1977 was far more rapid than that of any of the other institutes except the one concerned with the environmental health sciences. A national crusade to conquer cancer was initiated with the National Cancer Act of 1971, and a similar attack on heart disease was initiated with the National Heart, Blood Vessel, Lung, and Blood Act of 1972. Subsequent high appropriations for research in these areas pushed rates of growth well ahead of research in other areas like neurological diseases, arthritis, and allergy, to name some of the more established ones.

In 1978 and 1979, however, relative gains in research support for almost all the NIH areas surpassed cancer and heart and lung research although the two concerned institutes by this time accounted for one-half of all NIH research funding. The growth in research support to these two institutes was responsible for most of the rise in HEW research obligations in the years between 1970 and 1977.

Research funding for ADAMHA, which covers mental health, drug abuse, and alcoholism, actually declined somewhat between 1969 and 1976. In 1977, however, a rising trend began, partly as a result of administration interest in mental health. In the 1979 budget a 21-percent increase in requested funds, representing recommendations of the President's Commission on Mental Health, was subsequently granted by the Congress.

HEW has shown greatest real growth among the three leading Federal agencies that fund research programs. The average annual increase for HEW in the 1969-79 period is 2.6 percent in constant dollars, or an increase of 3.4 percent in the basic research component and an increase of 2.2 percent in the applied research component. Basic research is primarily concerned with understanding underlying phenomena related to life processes whereas applied research tends to be concerned with clinical testing and application. It should be mentioned that a reclassification of NIH research projects for greater accuracy in the 1980 budget will produce a higher level for the basic research share within the research total. The HEW research data for prior years will be readjusted, and the final result will be a slightly higher real growth rate for basic research.

DOD Research obligations for DOD reflected slow growth between 1969 and 1976, but more rapid growth has ensued between 1976 and 1979. The average annual rate of increase in the earlier years was 3.4 percent, or a decline in real terms, whereas the comparable gain in the more recent period (1976-79) is 9.1 percent, or 1.7 percent in real terms.

Most research efforts of the three services and the Defense Agencies are classified under the broad DOD program element headings of research (6.1) and exploratory development (6.2). These two areas combined make up the DOD technology base mission category. Work covers scientific study and experimentation directed toward increasing knowledge and understanding in fields of science related to security needs; building of a base for exploratory and advanced development in defense technologies and for improved military capabilities; and efforts directed toward the solution of specific military problems short of major development projects. Some research programs are also subsumed under advanced development (6.3), which covers all projects that have moved into the development of hardware for experimental or operational test with proof of concept as the underlying objective.

DOD research support in the early seventies reflected the fiscal constraints that were placed on overall defense budgets in those years, chiefly because of concern with inflation. Between 1969 and 1975 the DOD laboratories assumed an increasing share of technology base work, which moved from 25 percent to 43 percent of the laboratory total, as the total program shrank. The loss was borne by extramural contractors and grantees. This was a period when DOD support to universities showed a declining trend and industry support grew only slightly.

In 1976 an increase of 8 percent occurred in the technology base obligation level, following three years of almost level funding. Increases of between 7 percent and 13 percent were shown annually for the next three years in line with total R&D increases for DOD. In 1976, also, a policy was initiated of placing more laboratory-sponsored technology base work with outside performers with the aim of achieving an overall DOD laboratory share of 30 percent for such work by 1979. Thus, as obligations for research (technology base) have grown in recent years, more of the total funds have been obligated to industrial and university performers.

As far as universities are concerned, this increased work is likely to be in the form of basic research since more DOD basic research obligations are directed to universities than to any other sector (DOD laboratories are the next largest performance sector for basic research). As far as industry is concerned, larger research commitments are likely to be in the form of applied research since more DOD applied research support is directed to industry than to any other sector.

Federal obligations for research by agency: fiscal years 1969-79

[Dollars in millions]

Agency	Actual	Estimated			
	1969	1978[1]	Average annual rate of change 1969-78	1979[1]	Rate of change 1978-79
	Total research				
Total	$4,735	$9,858	+8.5	$10,483	+6.3
Department of Health, Education, and Welfare	1,174	2,750	+9.9	2,886	+4.9
Department of Defense	1,412	2,143	+4.7	2,320	+8.2
National Aeronautics & Space Adm.	803	1,359	+6.0	1,452	+6.9
Department of Energy[2]	417	1,005	+10.3	1,074	+6.9
National Science Foundation	258	748	+12.6	821	+9.7
Department of Agriculture	251	607	+10.3	611	+ .8
Department of the Interior	164	296	+6.8	298	+ .6
Environmental Protection Agency	—	238	—	236	- .7
Department of Commerce	56	193	+14.7	220	+13.9
Nuclear Regulatory Commission[3]	—	132	—	155	+17.3
Veterans Administration	50	101	+8.1	101	- .7
Department of Transportation	57	58	+ .2	60	+4.1
Other agencies	93	227	+10.4	249	+9.7
	Basic research				
Total	$1,779	$3,292	+7.1	$3,637	+10.5
Department of Health, Education, and Welfare	371	866	+9.9	982	+13.4
National Science Foundation	248	688	+12.0	755	+9.7
National Aeronautics & Space Adm.	380	468	+2.4	520	+11.0
Department of Energy[2]	285	433	+4.7	468	+8.2
Department of Defense	277	330	+2.0	371	+12.6
Department of Agriculture	107	251	+10.0	267	+6.3
Department of the Interior	55	159	+12.6	168	+5.9
Other agencies	58	98	+5.9	106	+8.0
	Applied research				
Total	$2,956	$6,565	+9.3	$6,846	+4.3
Department of Defense	1,135	1,814	+5.3	1,948	+7.4
Department of Health, Education, and Welfare	803	1,884	+9.9	1,904	+1.0
National Aeronautics & Space Adm.	423	890	+8.6	932	+4.7
Department of Energy[2]	132	572	+17.7	606	+5.9
Department of Agriculture	145	355	+10.5	345	-3.0
Environmental Protection Agency	—	229	—	219	-4.5
Department of Commerce	29	167	+21.6	190	+13.9
Nuclear Regulatory Commission[3]	—	132	—	155	+17.3
Department of the Interior	109	137	+2.6	130	-5.5
Other agencies	180	384	+8.8	417	+8.8

[1]Data are based on the President's 1979 budget to Congress. [2]Prior to 1974 Atomic Energy Commission data were used, and from 1974 to 1976 data for the Energy Research and Development Administration were used. [3]Part of the Atomic Energy Commission until 1974. SOURCE: National Science Foundation

In the 1969-79 decade, growth in DOD research funding in current dollars has not been sufficient to offset the effects of inflation. An average annual rate of decline of 1.5 percent in real terms is still reflected despite the substantial increases of the last three years. Within the research total the comparable rate of decline for basic research is 3.5 percent and for applied research, 1.0 percent.

All basic research within the DOD system is subsumed under the 6.1 research program element, either as part of in-house laboratory independent research or as part of defense research sciences, which may be pursued intramurally or extramurally. Some 6.1 activity is, of course, applied research. Basic research makes up no more than 20 percent of the DOD technology base total.

NASA Research support by NASA reached a high point in 1970 when work on a number of programs, including aeronautical research, space research, space sciences, and space applications combined to raise the total to the $1 billion mark. In the next two years the level fell, but from 1972 to 1976 a steady increase was registered in the NASA overall research effort, much of it stemming from the aeronautical research and technology, space science, and space shuttle programs, with the result that 1976 represented a new high of $1.2 billion.

Growth was planned in 1978 and 1979 after a slight 1977 decline, stemming from the fact that space shuttle work was by then almost entirely represented by development rather than research. The growth in the 1979 budget reflected substantial increases in support to the physics and astronomy programs within the space science area, to space applications, and to aeronautical research and technology. Currently physics and astronomy research is focused on investigations of the Earth's upper atmosphere and ionosphere, the magnetosphere, and the interplanetary medium.

Most research within NASA has been conducted in areas other than space flight programs. *Aeronautical and space technology* is the broad program area where the most research is conducted, nearly all of it applied. *Space science*, the second area, includes physics and astronomy, almost entirely basic, and lunar and planetary exploration, a mixture of basic and applied. The third most important NASA research area is *space applications*, covering such programs as earth resources monitoring, weather, and communication satellites, and here the character of work is applied.

Between 1969 and 1979 the NASA overall research effort, while recording a considerable gain in funding levels, remained almost unchanged in real terms. A decline of a fraction of 1 percent on an annual average is revealed in constant dollars. When research is examined in terms of basic versus applied, however, basic research reflects a real average annual decline of 3.3 percent, whereas applied research, now the larger portion of the research total, reflects annual average growth of 1.5 percent.

DOE The level of research funding within DOE and its predecessor agencies[19] scarcely changed from one year to the next in the early seventies. But the sudden expansion in energy R&D efforts that followed the Arab oil crisis in 1973 affected research programs as well as development. Between 1973 and 1979 the average annual increase in DOE energy research obligations is an estimated 8.2 percent in constant dollars, the highest of any agency except EPA where the total investment has been far smaller. It should be pointed out, however, that part of the DOE research growth arose from the transfer of programs to DOE from other agencies. In some years, especially 1975 and 1976, growth in energy research had a noticeable effect on the total Federal research level.

The leading research area within DOE and the predecessor energy agencies has always been that of *general science and basic research*, which consists of three major subprograms: Life sciences and biomedical applications, high-energy physics, and nuclear physics. The work in all these areas is considered basic except for the biomedical applications portion of the first program group.

The DOE *environmental R&D* program, another leading program area, has a sustained history of activity stemming from the original biomedical and environmental research program of AEC. Starting in 1975, greatly increased support was provided for this program, and it was given separate identity in 1976, and in 1977 picked up the NSF programs dealing with the environmental effects of energy. Most support to DOE environment work is for applied research although small amounts in the past have been devoted to basic research and to development.

Until 1975 the DOE *basic energy sciences* program was the second largest program area, but now it is third largest. The purpose of this program is to expand the knowledge base in science and engineering for all the energy production and conservation technologies. The character of work is entirely basic.

[19] For the years 1974-76 data for the Energy Research and Development Administration (ERDA) were used, and previous to 1974 data for the Atomic Energy Commission (AEC) were used. In 1974 the safety aspects of AEC work were placed under the Nuclear Regulatory Commission (NRC), a new agency.

About equal to basic energy sciences in size of effort is the DOE *atomic energy defense* program. Work is broadly divided between research toward inertial confinement fusion technology for national security and research to advance nuclear weaponization. Research in both these areas is applied in nature, and the larger portion is devoted to inertial confinement (laser) fusion that, in addition to defense uses, may some day produce an inexhaustible energy source.

Magnetic fusion research, once part of the broad physical research program of AEC, became a separate program entity in 1972 and began to reflect steep increases in funding in 1975. The sharpness of these increases has recently been diminished, but the rate of growth between 1974 and 1979 is 31.1 percent on an annual average. The goal of this program is to develop and demonstrate pure fusion central electric power generation in a manner that will meet environmental, economic, health, and safety requirements.

All programs taken together, research represents only one-fourth of the DOE R&D total. Ten years ago the proportion was somewhat higher, but the Federal sponsorship of large energy development programs has reduced the research share.

Between 1969 and 1979 the average annual real growth rate has been 3.1 percent for DOE research funding: a 1.5-percent rate of decline for basic research and a 9.2-percent rate of increase for applied research. In the 1979 budget, however, basic research growth was somewhat higher than applied.

NSF In the past decade-research funding for NSF has on two occasions shown sharp upward growth within a generally rising trend. The first period encompassed the two years 1971 and 1972 during which an unusually large number of proposals were received from investigators whose support had been dropped by DOD and other mission-oriented agencies as a result of the Mansfield Amendment to the 1970 military procurement authorization. This amendment restricted DOD to the support of research projects that had a "direct and apparent" relationship to specific military functions and operations. Although the language was softened in the 1971 authorization[20] and the restriction was dropped in subsequent DOD authorizations, the effect was to produce a major reorientation of the research support programs of DOD and some other agencies.

[20] See Section 203, Title II, P.L. 91-121, Military Procurement Authorization Act of Fiscal Year 1970, November 11, 1969 and Section 204, Title II, P.L. 92-441, Military Procurement Authorization Act of Fiscal Year 1971, October 7, 1970

NSF picked up from other agencies only those proposals that were of scientific merit, and these were estimated by NSF to total $75 million. The Foundation's budget requests for fiscal years 1971 and 1972 included $10 million and $40 million, respectively, to accommodate additional research project support as a result of dropouts from other agencies. These funds became part of the NSF budget base. In addition, the Foundation became responsible for support of a group of materials research laboratories at universities formerly supported by DOD and the logistic support for the U.S. Antarctic research program formerly provided by DOD. In later years, as other mission agencies continued to reassess and reorient their research support programs, additional proposals were directed to NSF, and many were absorbed within the base budget.

The second instance of sharp upward growth for NSF research support occurred in 1977 when the administration placed special emphasis on basic research as a part of budget strategy. In the two subsequent budgets, although this emphasis was continued, greater responsibility for basic research support was placed on mission agencies with the result that NSF increases were slowed.

In the 1969-79 decade *research project support*, almost entirely directed to the academic sector, has made up the largest share of all NSF research sponsorship, ranging from 56 percent to 70 percent of the research total. The largest share was in 1969 before the establishment and subsequent growth of the RANN program. As the RANN and the Antarctic programs grew, the share of research project support fell. Since 1973, however, the share of research project support has risen steadily to the present 65 percent. Virtually all the work under NSF research project grants has always been considered basic research; every major field of science is covered, and there is no specific mission orientation.

Basic research has additionally been sponsored by NSF through its support of six *National Research Centers* (five in astronomy and one in atmospheric sciences), through the *Antarctic* and *Arctic* research programs, and through a group of *special programs* conducted jointly with other agencies, such as the International Decade of Ocean Exploration (IDOE) and the ocean sediment coring program. These programs together made up 22 percent of all NSF research in the 1979 budget.

In the early seventies NSF also sponsored a program of general support to universities and colleges to assist them in upgrading their science capabilities. This program, which was designed to meet a

range of needs, had the broad title of *institutional improvement for science*. The research support portion of this program, all considered basic, made up as much as 9 percent of the NSF research support total in 1969 and 1970. The program was phased out by 1974, however.

Over the past decade basic research has represented between 80 percent and 96 percent of NSF research support. The lowest share was seen in 1974 when the RANN program was almost at its height. In 1970 the RANN program was begun under the title, *Interdisciplinary Research on Problems of Our Society (IRPOS)*, to meet the intent of Congress that NSF sponsor applied scientific research related to national problems.[21] This program grew very rapidly until 1975 but has thereafter been reduced as the RANN energy programs were absorbed by the newly established Energy Research and Development Administration (ERDA) in 1976 and 1977 and as NSF reorganization in 1978 changed the emphasis of the program as well as the name. The new ASRA program is focused on selected research applications where NSF can make a unique contribution and on strengthening the links between NSF basic research and applied research activities.

In the 1979 budget the ASRA program accounted for 10 percent of the NSF research total. Applied research was approximately 60 percent of the ASRA program, representing virtually all NSF research.

In the 1969-79 decade NSF research obligations have grown at an average annual rate of 5.2 percent in constant dollars, a higher rate than has been the case for the four largest research support agencies. Basic research has grown at an average annual rate of 4.8 percent in real terms and applied research at a comparable rate of 12.3 percent, starting from a small base.

USDA The Department of Agriculture (USDA) has reflected a steady increase in research funding in the 1969-79 decade, with the growth more rapid in recent years. Three USDA units contribute to research sponsorship: The Science and Education Administration, encompassing *Agricultural Research (AR)*, slightly more than 50 percent of the research total, and *Cooperative Research (CR)*, approximately 25 percent; the *Forest Service (FS)*, 16 percent; and the *Economics, Statistics, and Cooperatives Service (ESCS)*, 6 percent.

For many years the research within AR has nearly all been conducted intramurally, in animal production, plant production, and the use and improvement of soil, water, and air. This research is almost equally divided between basic and applied with a slight tilt toward applied.

Within CR, on the other hand, research funds are chiefly directed to universities and colleges, mostly as payments to agricultural experiment stations under the Hatch Act, with the rest directed to extramural work on specified national problems, to 1890 land-grant institutions and Tuskegee Institute, and to a program of cooperative forestry research. In the last two budget years a new competitive research grants program has been added, encouraging basic research by all types of performers in food production and human nutrition. Basic research in 1979 is approximately 50 percent of the CR total, up from 38 percent in 1977.

The Forest Service has conducted a range of research programs on trees, timber, and watershed management, wildlife, recreation, fire control, forest insects and disease, forest products utilization, and renewable resources. Almost one-third is basic, the rest applied.

ESCS is made up of three subdivisions, of which the most important in terms of research is the Economics Service where research is mostly applied.

Over the 1969-79 period USDA research support has increased 2.5 percent on an average annual basis in constant dollars: basic research 2.8 percent, and applied research 2.3 percent. Since 1975 the basic research share has grown from 38 percent to 44 percent of total research, partly as a result of the competitive research grants program.

[21] See P.L. 90-407, July 18, 1968.

Section 3. GEOGRAPHIC DISTRIBUTION, 1977

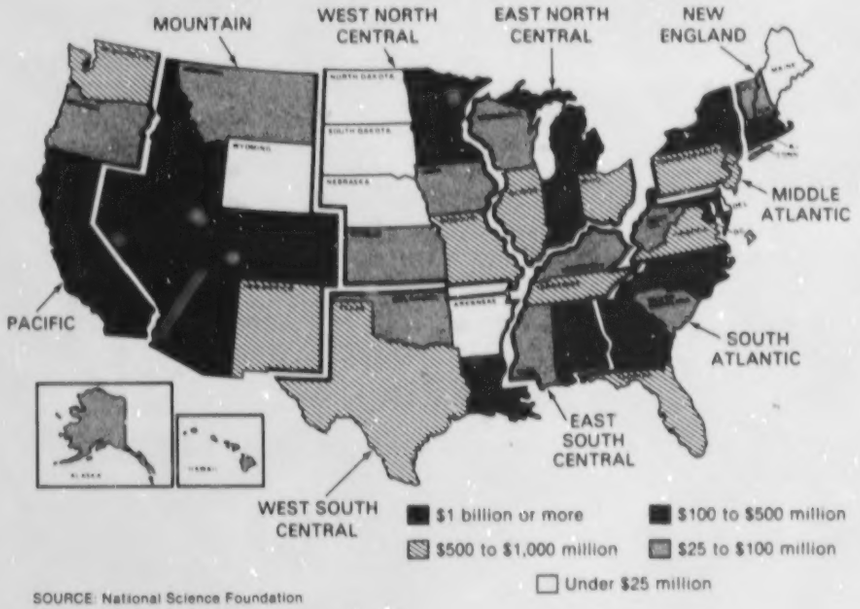
For 1977 Federal R&D obligations of $23.3 billion were reported by 10 participating agencies, representing almost 98 percent of the Federal R&D effort that year.[22] These agencies also reported $1.3 billion in R&D plant obligations.

Data are reported on a prime contract basis, although additional data were obtained from NASA on the effects of first-tier subcontracting in 1977.[23] The NASA data indicate that when subcontracting is taken into account, most States show an increase in share of the R&D total as a result of funds subcontracted out of California, the largest recipient State. Some change in ranking occurs, but the same States remain in the leader group.

Synopsis

- In 1977 every State and the District of Columbia[24] received Federal R&D support. California received the largest amount—$6.1 billion—and South Dakota the smallest amount—$8.0 million.
- Four States—California, Maryland, Massachusetts, and New York—each reflected more than $1 billion in Federal R&D obligations. The same situation prevailed for these States in 1974, 1975, and 1976, and the same rank order prevailed in size of support.
- Twelve States, including the District of Columbia, were recipients of Federal R&D funds in the $500-million-to-$1 billion category in 1977.
- Fourteen States received from $100 million to $500 million in Federal funds for R&D performance.
- Fourteen States reflected support levels between $25 million and $100 million, and the seven remaining States received less than $25 million.
- In 1977 a total of 30 States each received more than $100 million in Federal R&D support, and 20 States each accounted for more than 1 percent of the Federal R&D total.

Distribution of total Federal R&D obligations by State: FY 1977



SOURCE: National Science Foundation

[22] The Departments of Agriculture; Commerce; Defense; Energy; the Interior; Transportation; and Health, Education, and Welfare; the Environmental Protection Agency; the National Aeronautics and Space Administration; and the National Science Foundation.

[23] See National Aeronautics and Space Administration, Office of Procurement, *Annual Procurement Report, Fiscal Year 1977* (Washington, D.C.).

[24] For purposes of this analysis the District of Columbia is considered a State.

Trends in State Support

Over the 14-year period that data have been collected on the distribution of Federal R&D obligations to the various States, approximately one-half of the States have accounted for 95 percent of the total. Carrying the analysis further, the leading 15 States have accounted for somewhat more than 80 percent of the total, and 17 or 18 States have each accounted for 2 percent or more of the total. These States have been the same ones, year after year, even though their rank order may have changed. They are the States most useful to analyze in terms of R&D capabilities as well as the impact of Federal support on their economies.

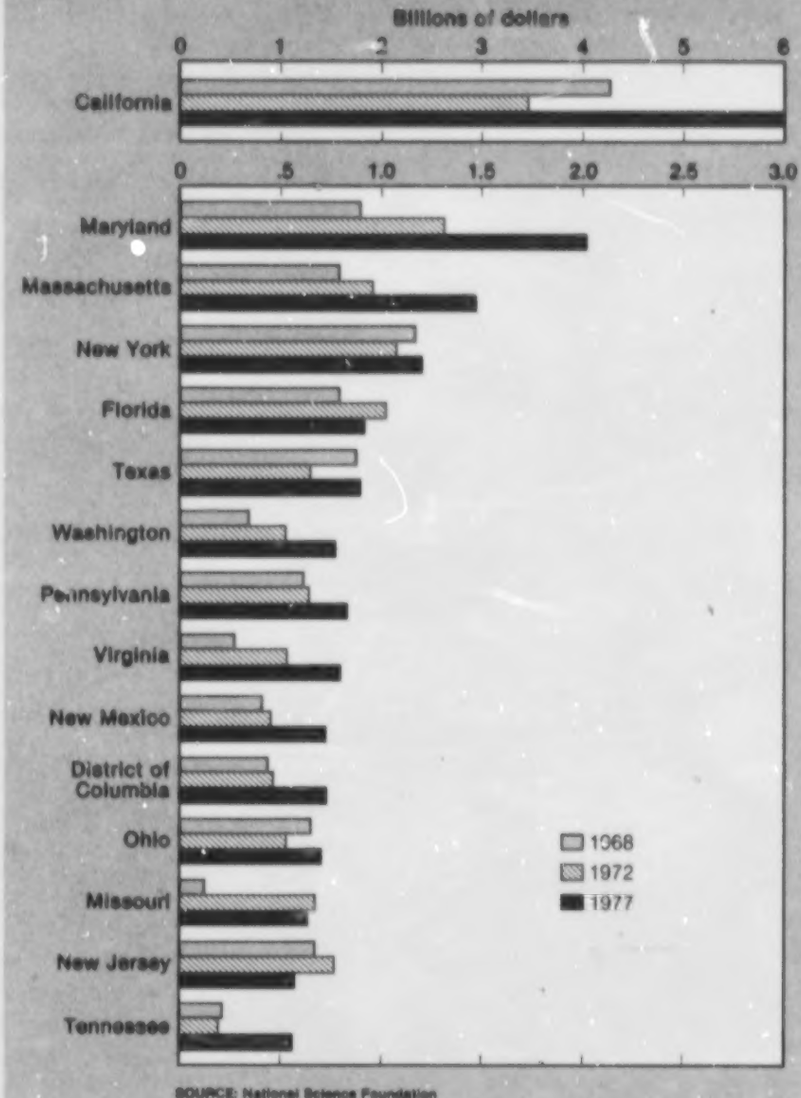
California has always remained in the lead in receipt of R&D funds. This State possesses highly developed industrial capabilities in the aircraft, aerospace, and electronics fields; a wide diversity of university skills; and favorable locations for a number of Federal laboratories and test facilities. California has never represented less than 21 percent of the Federal R&D total, and in 1977 represented 26 percent.

The second-ranking States have been New York (from 1963 to 1970) and Maryland (from 1971 to 1977). At no time has either of these States received more than 9 percent of the Federal R&D total. In 1977 the Maryland share was almost 9 percent, followed by Massachusetts with 6 percent and New York with 5 percent. Since 1970 the New York share has tended to decline despite high levels of support received by this State.

The strong growth of **Maryland** is largely accounted for by the numerous and growing Federal R&D installations in this State, typified by the National Institutes of Health (HEW), the Naval Air Test Center (DOD), the Goddard Space Flight Center (NASA), the Agricultural Research Center (USDA) and the National Bureau of Standards (Commerce). Even though Federal intramural performance leads in Maryland, industrial performance is also important, especially in aircraft and space-related activities for DOD and NASA.

Massachusetts, which has been third in amount of Federal R&D support since 1973, is heavily dependent on DOD funds, which provide approximately 70 percent of the support to this State. Most support is directed to industrial performance and the next largest amount to Federal intramural activities. HEW, the second support agency, makes extensive use of university skills in Massachusetts.

Federal R&D support to the 15 States leading in such support in 1977 for selected years



SOURCE: National Science Foundation

New York, which has maintained fourth place since 1974, shows greater balance among R&D sponsors and R&D-performing sectors. While DOD accounted for 44 percent of the R&D total in 1977, another 24 percent was provided by HEW, and 17 percent by DOE. Industrial capabilities in New York State, represented in this connection by aircraft firms, are drawn on by DOD, while advanced health research resources in the university and other nonprofit sectors are utilized by HEW (NIH).

Florida is a State that has always been among the leaders in Federal R&D support, and at the present time this State has moved into fifth place with more than $900 million in R&D obligations from Federal agencies in 1977. The share of Florida in the Federal R&D total was almost 4 percent. Nine out of 10 Federal R&D dollars are provided by DOD and NASA, and the total support of these agencies is almost evenly divided between intramural and industrial activities. Most intramural performance now takes place at the Kennedy Space Center in connection with NASA space transportation systems development and at Eglin Air Force Base and Patrick Air Force Base, the site of the Eastern Test Range, in connection with DOD aircraft and missiles development.

Texas, a State whose Federal R&D activities are mostly tied to programs of NASA and DOD, reached a low point in funding in 1971 as a result of the declining R&D activities of these agencies at that time. Since then funds to Texas have shown a steady rise, mostly as a reflection of work by NASA in space sciences and space transportation systems at the Lyndon B. Johnson Space Center in Houston and for NASA by aerospace and electronics firms and for DOD by aircrafts and missiles companies. In recent years DOD support to industry has increased considerably. In 1977 three-fourths of all Federal R&D support to Texas was in the form of DOD and NASA intramural and industrial performance. Texas accounted for almost 4 percent of the Federal R&D total in 1977.

Washington has gained considerably in Federal R&D support in the last 10 years and in 1977 received almost as much in obligations as Texas—nearly 4 percent of the total. This State is heavily dependent on DOD and DOE for R&D support. These agencies in 1977 accounted for more than four out of five Federal R&D dollars. DOD funds were mainly directed to aircraft, missile, and electronics firms, and DOE funds were directed to work on nuclear fission at the Hanford Engineering Development Laboratory, an industry-administered FFRDC, and on biomedical and environmental energy problems at the Pacific Northwest Laboratory, a nonprofit-administered FFRDC—both of them located at Richland.

Pennsylvania, with more than 3½ percent of all Federal R&D obligations in 1977, has always been among the leading States. Support is chiefly derived from DOD, DOE, and HEW. More than one-half of the R&D activities are industrially performed, an important share accounted for by the DOE Bettis Atomic Power Laboratory, industry-administered FFRDC in Pittsburgh. Intramural activities made up 20 percent of the Federal R&D total in 1977, covering work at various DOD installations as well as demonstrations in fossil fuels by the Bureau of Mines (Interior). Universities and other nonprofit institutions, making up slightly more than one-fifth of the R&D total, were chiefly supported by HEW and NSF.

Virginia is a State where Federal R&D performance has grown considerably in recent years, mostly influenced by DOD and NASA, which in 1977 together accounted for more than four-fifths of all

Distribution of Federal R&D obligations to the 15 States leading in such support in FY 1977 for selected years

[Dollars in millions]

State	1968	1972	1976	1977
Total, all States	$15,690	$16,262	$20,255	$23,344
	Percent distribution			
California	27.4%	21.4%	27.1%	26.2%
Maryland	5.8	8.1	8.9	8.7
Massachusetts	5.1	5.9	6.3	6.3
New York	7.5	6.6	5.5	5.2
Florida	5.1	6.3	3.9	3.9
Texas	5.6	4.0	4.1	3.8
Washington	2.2	3.3	3.5	3.8
Pennsylvania	3.9	3.9	4.1	3.6
Virginia	1.8	3.3	3.7	3.4
New Mexico	2.6	2.8	3.1	3.2
District of Columbia	2.8	2.8	2.8	3.1
Ohio	4.2	3.2	3.1	3.0
Missouri	.8	4.2	2.0	2.7
New Jersey	4.3	4.7	2.4	2.4
Tennessee	1.3	1.2	2.1	2.3
All other States[1]	19.6	18.3	17.4	18.4

[1] Includes outlying areas and offices abroad

Federal R&D obligations by geographic division and State for selected years

[Dollars in millions]

Division and State	1968	1972	1976	Net increase/ decrease 1968-76	1977	Net increase/ decrease 1976-77
Total, all States	$15,690.2	$16,261.8	$20,190.6	+$4,500.4	$23,343.8	+$3,153.2
Pacific	4,774.3	4,158.2	6,363.8	+1,589.5	7,142.2	+778.4
Alaska	61.8	46.0	35.4	-26.4	35.8	+ .4
California	4,298.6	3,473.1	5,493.7	+1,195.1	6,106.6	+612.9
Hawaii	35.0	47.4	45.5	+10.5	36.9	-8.6
Oregon	35.0	53.7	84.1	+49.1	84.3	+ .2
Washington	343.9	537.9	705.1	+361.2	878.6	+173.5
South Atlantic	2,819.7	3,560.6	4,224.9	+1,405.2	4,875.4	+650.5
Delaware	13.9	17.4	7.9	-6.0	15.3	+7.4
District of Columbia	443.2	462.1	570.2	+127.0	729.6	+159.4
Florida	799.1	1,022.5	788.1	-11.0	919.1	+131.0
Georgia	280.7	71.9	91.9	-188.8	110.8	+18.9
Maryland	905.9	1,318.1	1,810.1	+904.2	2,030.2	+220.1
North Carolina	62.4	83.3	139.1	+76.7	154.7	+15.6
South Carolina	18.7	26.3	30.7	+12.0	67.0	+36.3
Virginia	275.2	529.6	750.6	+475.4	799.2	+48.6
West Virginia	20.6	29.4	36.4	+15.8	49.7	+13.3
Middle Atlantic	2,473.4	2,481.0	2,437.6	-35.8	2,606.5	+168.9
New Jersey	681.8	763.1	495.6	-186.2	566.2	+70.6
New York	1,174.9	1,075.6	1,106.1	-68.8	1,202.8	+96.7
Pennsylvania	616.7	642.3	836.0	+219.3	837.5	+1.5
New England	1,009.4	1,259.8	1,715.5	+706.1	1,963.0	+247.5
Connecticut	133.2	169.2	239.4	+106.2	291.7	+52.3
Maine	6.0	16.3	15.3	+9.3	18.0	+2.7
Massachusetts	795.7	961.2	1,284.9	+489.2	1,474.4	+189.5
New Hampshire	36.6	21.5	34.6	-2.0	32.5	-2.1
Rhode Island	31.1	68.9	101.6	+70.5	109.9	+8.3
Vermont	6.8	22.8	39.5	+32.7	36.4	-3.1
East North Central	1,294.0	1,179.6	1,437.3	+143.3	1,724.0	+286.7
Illinois	239.3	291.0	414.0	+174.7	517.0	+103.0
Indiana	82.9	100.5	92.3	+9.4	102.7	+10.4
Michigan	203.4	186.3	221.0	+17.6	315.4	+94.4
Ohio	653.6	521.7	627.4	-26.2	694.4	+67.0
Wisconsin	114.8	80.1	82.5	-32.3	94.5	+12.0
Mountain	1,093.6	1,214.4	1,392.8	+299.2	1,719.2	+326.4
Arizona	71.4	89.9	121.8	+50.4	141.9	+20.1
Colorado	265.3	369.1	247.1	-18.2	322.5	+75.4
Idaho	65.6	75.9	71.7	+6.1	118.7	+47.0
Montana	8.3	19.0	27.6	+19.3	45.5	+17.9
Nevada	223.6	140.3	179.0	-44.6	183.5	+4.5
New Mexico	413.3	451.5	625.8	+212.5	750.9	+125.1
Utah	39.7	58.9	100.7	+61.0	132.3	+31.6
Wyoming	6.4	9.9	19.1	+12.7	23.9	+4.8
East South Central	655.3	638.9	919.5	+264.2	1,131.0	+211.5
Alabama	405.7	359.0	374.4	-31.3	433.6	+59.2
Kentucky	24.1	32.1	50.7	+26.6	56.2	+5.5
Mississippi	26.5	60.7	71.4	+44.9	95.2	+23.8
Tennessee	199.1	187.1	423.0	+223.9	546.0	+123.0
West South Central	1,188.9	798.9	1,019.7	-169.2	1,124.9	+105.2
Arkansas	8.1	13.2	26.5	+18.4	24.3	-2.2
Louisiana	272.4	103.6	125.9	-146.5	156.4	+30.5
Oklahoma	24.0	29.1	31.7	+7.7	47.7	+16.0
Texas	884.4	653.0	835.6	-48.8	896.5	+60.9
West North Central	321.1	906.0	678.2	+357.1	971.2	+293.0
Iowa	41.7	37.9	47.9	+6.2	59.4	+11.5
Kansas	19.8	31.3	32.0	+12.2	36.2	+4.2
Minnesota	111.1	127.0	153.0	+41.9	186.2	+33.2
Missouri	121.1	679.5	403.3	+282.2	638.4	+235.1
Nebraska	15.4	11.7	21.0	+5.6	24.1	+3.1
North Dakota	6.0	10.5	14.3	+8.3	18.7	+4.4
South Dakota	6.0	8.1	6.8	+ .8	8.0	+1.2
Outlying areas	(1)	18.4	.3	—	47.7	+47.4
Office abroad	(1)	46.1	1.0	—	38.6	+37.6

(1) U.S. territories and offices abroad are included in the totals but not shown separately.

SOURCE: National Science Foundation

Federal R&D obligations. Intramural work is somewhat more heavily funded than industrial; the chief installations are a cluster of Army laboratories at Fort Belvoir and the NASA Langley Research Center at Hampton and Wallops Flight Center at Wallops Island. DOD support of industry is chiefly represented by Navy ship-related R&D contracts. Virginia accounted for more than 3 percent of the Federal R&D total in 1977.

New Mexico offers the special advantage of remoteness from population centers for purposes of testing weaponry and atomic devices. For many years this State has been the site of special R&D testing facilities of DOE (and predecessor agencies) and DOD. These two agencies accounted for 95 percent of all Federal R&D support in 1977. DOE work is almost entirely concentrated in the industry-administered Sandia Laboratory, an FFRDC at Albuquerque and in the university-administered Los Alamos Scientific Laboratory, an FFRDC at Los Alamos. Each of these laboratories places chief emphasis on the development of atomic weapons. The primary DOD installations in New Mexico are the Army White Sands Missile Range and the Air Force Weapons Laboratory at Kirtland Air Force Base. In 1977 New Mexico comprised slightly more than 3 percent of the Federal R&D total.

The next five States in receipt of Federal R&D obligations in 1977 were the **District of Columbia** (headquarters for most Federal agencies), **Ohio, Missouri, New Jersey,** and **Tennessee.** Each one of these represented between 2 percent and slightly more than 3 percent of the Federal R&D total. In the case of Ohio, Missouri, and New Jersey DOD support was predominant, directed especially to industrial firms, although Ohio and New Jersey also contain large DOD installations for intramural R&D work. Tennessee, on the other hand, derives the major share of its Federal R&D funds from DOE for work at the industry-administered Oak Ridge National Laboratory and university-administered Oak Ridge Institute of Nuclear Studies—both of them FFRDC's.

72

71

Distribution of Funds by Performer

Because of the size of their R&D efforts, DOD, NASA, HEW, and DOE have had the major influence on the distribution of R&D funds to the various States. Among the leading 15 States in 1977, 12 received more of their R&D funds from DOD than from any other agency, two received chief support from DOE, and one from NASA. HEW was second or third in size of R&D support in 12 of these States.

Therefore, the States with R&D capabilities most suitable to the needs of these agencies will be most likely to lead in R&D support. These will be States with aircraft, aerospace, and electronics industries, effective concentrations of university research talent, including modern medical research teams, and geographic areas safe and adaptable for testing missiles, aircraft, spacecraft, and explosives; many of these areas are located on seacoasts.

When States are compared on the basis of performing sectors, it can be seen that those that remain among the four or five leaders in receipt of Federal funds year after year contain a strong balance of capabilities. Thus, in 1977 California led in R&D obligations directed to industrial firms, to universities and their associated FFRDC's, and to other nonprofit institutions. Maryland led in Federal intramural support, and here California was second.

Maryland and Massachusetts were among the seven leading States in Federal R&D funds to industry, to universities and to their associated FFRDC's, and Massachusetts ranked second in Federal R&D support to other nonprofit institutions.

New York was among the leading five States in Federal R&D support to industry, to universities and associated FFRDC's and other nonprofit institutions.

Florida and Texas were among the leading 10 States to receive Federal R&D obligations for both intramural and industrial work, and Texas also ranked fourth in R&D funds to universities and colleges.

Concentrations of Federal R&D funds among a few States are found in situations where the number of performers in a sector are relatively few. Thus, in the case of university-administered FFRDC's, 97 percent of the Federal R&D funds were directed to 10 States in 1977, and in the case of other nonprofit institutions, 82 percent of the funds were directed to 10 States. In the case of universities and colleges, which are distributed widely, only 61 percent of the Federal R&D funds to this sector were allotted to the leading 10 States in 1977. For Federal R&D obligations to intramural performance and to industry, 76 percent of the funds in each case was accounted for by the leading 10 States in 1977.

Federal R&D obligations to each performing sector in the 10 States leading in support to that sector: FY 1977

[Dollars in millions]

Federal intramural		Industrial firms[1]		Universities and colleges		FFRDC's administered by universities		Other nonprofit institutions[1]	
Total	$5,922	Total	$12,138	Total	$2,834	Total	$1,305	Total	$948
Maryland	1,284	California	4,303	California	407	California	453	California	204
California	704	Massachusetts	731	New York	309	New Mexico	231	Massachusetts	194
District of Columbia	475	Washington	673	Massachusetts	285	Illinois	197	New York	83
Florida	430	New York	592	Texas	141	Maryland	125	Washington	80
Virginia	365	Missouri	535	Pennsylvania	137	New York	99	Virginia	52
Ohio	319	Maryland	519	Illinois	126	Massachusetts	65	Pennsylvania	42
Alabama	273	Texas	495	Maryland	90	New Jersey	40	District of Columbia	41
Texas	236	Pennsylvania	470	Michigan	85	Colorado	21	Illinois	31
New Jersey	208	Tennessee	470	Washington	73	Idaho	19	Ohio	28
Massachusetts	193	Florida	422	Wisconsin	71	Pennsylvania	13	Minnesota	21
All other States[2]	1,435	All other States[2]	2,928	All other States[2]	1,110	All other States[2]	42	All other States[2]	172

[1] Includes federally funded research and development centers administered by this sector.
[2] Includes outlying areas and offices abroad.

73

74

R&D Plant

- Among the 10 States leading in Federal support to R&D plant in 1977 6 were among the leading 10 and 8 were among the leading 15 in Federal R&D obligations.
- North Carolina and Illinois received R&D plant funds in 1977 even though these States were not among the leading 15 in R&D obligations (Illinois was 16th). These funds chiefly reflected construction of the Environmental Health Sciences Center for HEW and initiation of the Intense Pulsed Neutron Source project at Argonne National Laboratory for DOE.
- In 1977 California received the most support for R&D plant for the seventh successive year, most of it from DOD but a large amount also from DOE in connection with the Positron Electron Joint Project (PEP) colliding beam storage ring facility at the Stanford Linear Accelerator Center.
- Florida was once again the recipient of R&D plant obligations from DOD and NASA, mostly for intramurally conducted R&D activities at Air Force bases and at the Kennedy Space Center.
- New Mexico and Washington also reflected R&D plant obligations of DOE: continuation of work on the Combustion Research Facility at Sandia Laboratory; work on the high-intensity Neutron Source Facility at Los Alamos; and work on the high-performance Fuel Laboratory, Fuel Storage Facility, and Fast Flux Test Facility at the Hanford Engineering Development Laboratory.
- As has been the case for a number of years, DOE reported the most obligations for R&D plant. Aside from the States already mentioned, the construction activities of DOE included work on the Tokamak Fusion Test Reactor at the Plasma Physics Laboratory in Princeton, New Jersey and work on the National Synchrotron Light Source at the Brookhaven National Laboratory at Upton, New York.

Federal obligations for R&D plant in the 10 States leading in such support by agency: FY 1977

[Dollars in millions]

State	Total	DOE	DOD	HEW	NASA	NSF	DOT	USDA	Other[1]
Total	$1,334	$561	$446	$133	$118	$27	$23	$13	$14
California	303	99	169	—	19	6	10	[2]	[2]
Florida	155	—	105	—	49	—	—	[2]	1
New Mexico	138	106	31	—	[2]	[2]	—	[2]	[2]
Washington	113	113	[2]	—	[2]	—	—	[2]	[2]
Maryland	80	1	22	49	3	—	[2]	[2]	5
North Carolina	67	[2]	—	66	[2]	—	—	[2]	[2]
New Jersey	65	58	2	—	[2]	—	3	—	1
New York	61	44	5	4	1	1	—	2	4
Ohio	60	2	48	2	8	[2]	—	[2]	[2]
Illinois	52	45	6	1	[2]	[2]	—	[2]	[2]
All other States[3]	240	93	58	11	38	20	10	11	3

[1] Includes the Departments of Commerce and the Interior and the Environmental Protection Agency.
[2] Less than $500,000.
[3] Includes outlying areas and offices abroad.
SOURCE: National Science Foundation.

APPENDIXES

A. Technical Notes
B. Federally Funded Research and Development Centers, Fiscal Years 1977-79
C. Listing of Statistical Tables and Summary Tables

NOTE

The detailed statistical tables for this volume, appendix C, have been published separately under one cover.

Included on pp. 44-49 in this volume are appendix C summary tables 1, 2, and 3, as well as a complete listing of all the tables. Detailed statistical tables may be obtained gratis from the National Science Foundation, Washington, D.C. 20550.

APPENDIX A
Technical Notes

SCOPE AND METHOD

Between March and May of 1978 a total of 36 Federal agencies and their subdivisions—94 individual respondents—submitted data in response to a survey questionnaire developed by the Foundation and distributed in January 1978. With the exception of NASA, the data received from the agencies were in terms of obligations and outlays incurred, or expected to be incurred, regardless of when the funds were appropriated or whether they were identified in the respondent's budget specifically for R&D activities. NASA reported its 1977, 1978, and 1979 transactions in terms of budget plan, which approximates obligations.

Federal agencies provided R&D data earlier to the Office of Management and Budget (OMB) for inclusion in "Special Analysis P: Research and Development" in *The Budget of the United States Government, Fiscal Year 1979*. Although the R&D data in that report and this one are reconcilable (see Relation to Other Reports, p. 37), the data in the *Federal Funds* report are more comprehensive and are tabulated in greater detail. Also, the *Federal Funds* report incorporates revisions that have resulted from changes made in the R&D portion of the budget subsequent to the budget message of the President to Congress in January 1978.

DEFINITIONS

The definitions are essentially unchanged from prior issues of the *Federal Funds* series.

1. Research, Development, and R&D Plant

This term includes all direct, indirect, incidental, or related costs resulting from or necessary to research, development, and R&D plant, regardless of whether the research and development are performed by a Federal agency (intramural) or performed by private individuals and organizations under grant or contract (extramural). Research and development exclude routine product testing, quality control, mapping and surveys, collection of general-purpose statistics, experimental production, and activities concerned primarily with the dissemination of scientific information and the training of scientific manpower.

a. **Research** is systematic, intensive study directed toward fuller scientific knowledge or understanding of the subject studied. Research is classified as either basic or applied.

In **basic research** the investigator is concerned primarily with gaining a fuller knowledge or understanding of the subject under study.

In **applied research** the investigator is primarily interested in a practical use of the knowledge or understanding for the purpose of meeting a recognized need.

b. **Development** is systematic use of the knowledge and understanding gained from research, directed toward the production of useful materials, devices, systems, or methods, including design and development of prototypes and processes. It includes quality control, routine product testing, and production.

c. **R&D plant** (R&D facilities and fixed equipment, such as reactors, wind tunnels, and radio telescopes) includes acquisition of, construction of, major repairs to, or alterations in structure, works, equipment, facilities, or land, for use in R&D activities at Federal or non-Federal installations. Excluded from the R&D plant category are expendable equipment and office furniture and equipment. Obligations for foreign R&D plant are limited to Federal funds for facilities located abroad and used in support of foreign research and development.

2. Obligations and Outlays

a. **Obligations** represent the amounts for orders placed, contracts awarded, services received, and similar transactions during a given period, regardless of when the funds were appropriated and when future payment of money is required.

b. **Outlays** represent the amounts for checks issued and cash payments made during a given period, regardless of when the funds were appropriated.

The obligations and outlays reported cover all transactions from all funds available to the agency from direct appropriations, trust funds or special account receipts, corporate income, or other sources, including funds appropriated by the President, that the agency received or expects to receive. The amounts reported for each year reflect obligations and outlays for that year regardless of when the funds were originally authorized or received and regardless of whether they were appropriated, received, or identified in the agency's budget specifically for research, development, or R&D plant.

An agency making a transfer of funds to another agency includes such transfers in its report of obligations and outlays. The receiving agency does not report, for purposes of this survey, funds transferred to it from another agency. Similarly, a subdivision of an agency that transfers funds to another subdivision within that agency reports such obligations or outlays as its own.

Obligations and outlays for work performed in foreign countries include funds directly available to Federal agencies and special foreign currencies separately appropriated. The latter currencies are derived largely from provisions of Public Law 480, 1954, as amended.

3. Cost Coverage

Funds reported for research and development reflect full costs. In addition to costs of specific R&D projects, the applicable overhead costs are also included. The amounts reported include the costs of planning and administering R&D pro-

78

79

grams, laboratory overhead, pay of military personnel, and departmental administration.

4. Fiscal Year

The fiscal year in the Government accounting period begins October 1 of one year and ends September 30 of the following year; thus, fiscal year 1977 began on October 1, 1976 and ended September 30, 1977.

5. Agency

An agency is an organization of the Federal Government whose principal executive officer reports to the President. The only exception is the Library of Congress, also included in the survey, whose executive officer reports to Congress. The term subdivision refers to any major organizational unit of a reporting agency, such as a bureau, division, office, or service.

6. Performers

Performers are either intramural organizations accomplishing operating functions or extramural organizations or persons receiving support or providing services as a result of a contract or grant.

a. **Intramural performers** are the agencies of the Federal Government. Their work is carried on directly by their own personnel. Obligations reported under this category are for activities performed by the reporting agency itself, or they represent funds that the agency transfers to another Federal agency for performance for work. The ultimate performer must be a Federal agency. If the ultimate performer is not a Federal agency, the funds so transferred are reported by the transferring agency under the appropriate extramural performer category (industrial firms, universities and colleges, other nonprofit institutions). Intramural performance includes the costs of supplies and equipment, essentially of an "off-the-shelf" nature, that are procured for use in intramural research and development. Also included as part of the intramural performance total are the expenses of Federal personnel engaged in planning and administering intramural and extramural R&D programs.

b. **Extramural performers** are all organizations outside the Federal sector that perform with Federal funds under contract or grant. Only those costs associated with actual extramural R&D performance are reported, but these would include costs of materials and supplies to carry out R&D activities. However, the costs of "off-the-shelf" supplies and equipment procured from extramural suppliers and required to support intramural research and development should be considered as part of the costs of intramural performance and not as part of the costs of extramural performance. Extramural performers are identified as follows:

i. *Industrial firms* are those organizations that may legally distribute net earnings to individuals or to other organizations.

ii. *Universities and colleges* are institutions engaged primarily in providing resident instruction for at least a 2-year program above the secondary school level. Included are colleges of liberal arts; schools of arts and sciences; professional schools, such as in engineering and medicine, including affiliated hospitals; associated research institutes; and agricultural experiment stations.

iii. *Other nonprofit institutions* are private organizations other than educational institutions, no part of whose net earnings inure to the benefit of a private stockholder or individual, and other private organizations organized for the exclusive purpose of turning over their entire net earnings to such nonprofit organizations.

iv. *Federally funded research and development centers* are R&D-performing organizations exclusively or substantially financed by the Federal Government that are supported by the Federal Government either to meet a particular R&D objective or, in some instances, to provide major facilities at universities for research and associated training purposes. Each center is administered by one of the above extramural performers.

In general, all of the following qualification criteria are met by an institutional unit before it is included in the federally funded research and development center category: (1) Its primary activities include one or more of the following: basic research, applied research, development, or management of research and development (specifically excluded are organizations engaged primarily in routine quality control and testing, routine service activities, production, mapping and surveys, and information dissemination); (2) it is a separate operational unit within the parent organization or is organized as a separately incorporated organization; (3) it performs actual research and development or R&D management either upon direct request of the Federal Government or under a broad charter from the Federal Government, but in either case under the direct monitorship of the Federal Government; (4) it receives its major financial support (70 percent or more, from the Federal Government, usually from one agency; (5) it has or is expected to have a long-term relationship with its sponsoring agency (about 5 years or more), as evidenced by specific obligations assumed by it and the agency; (6) most or all of its facilities are owned or are funded through the contract with the Federal Government; and (7) it has an average annual budget (operating and capital equipment) of at least $500,000.

v. *State and local governments* are State and local government agencies, excluding State and local universities and colleges, agricultural experiment stations, medical schools, and affiliated hospitals. Federal R&D funds obligated directly to such State and local educational institutions are included under the universitites and colleges sector in this survey. Research and development under the State and local category are performed either by the State or local agencies themselves or granted or contracted by such agencies for performance by other organizations. Regardless of the ultimate performer, Federal R&D funds directed to State and local governments are reported under the State and local government sector and no other.

vi. *Foreign performers* are foreign citizens, organizations, or governments, as well as international organizations, such as NATO, UNESCO, WHO, performing work aboard financed by the Federal Government. Excluded are payments to U.S. agencies, organizations, or citizens performing research and development abroad for the Federal Government (the survey objectives do not include information on "offshore" payments). Also excluded are payments to foreign scientists performing in the United States.

vii. *Private individuals.* In the case of R&D grants and contracts awarded directly to a private individual, obligations are reported under "industrial firms."

7. Fields of Science

The fields of science in this survey are divided into eight broad field categories, most of them consisting of a number of detailed fields. The broad fields are life sciences, psychology, physical sciences, environmental sciences, mathematics and computer sciences, engineering, social sciences, and other sciences not elsewhere classified. The following listing presents the fields grouped under each of the broad fields, together with illustrative disciplines.

a. **Life sciences** consist of the biological, clinical medical, other medical sciences, and life sciences not elsewhere classified.

Life sciences include the following disciplines: Anatomy; animal sciences; bacteriology; biochemistry; biogeography; biological oceanography; biophysics; dentistry; ecology; embryology; entomology; evolutionary biology; genetics; immunology; internal medicine; microbiology; neurology; nutrition and metabolism; opthalmology; parasitology; pathology; pharmacology; pharmacy; physical anthropology; physical medicine and rehabilitation; physiology; plant sciences; podiatry; preventive medicine and public health; psychiatry; radiobiology; radiology; surgery; systematics; veterinary medicine.

Research in some of these disciplines may be classed as biological, clinical medical, or other medical, depending upon the nature of the particular project.

Biological sciences are those which, apart from the clinical medical and other medical sciences as defined below, deal with the origin, development, structure, function, and interactions of living things.

Clinical medical sciences are concerned with the study of the pathogenesis, diagnosis, or therapy of a particular disease

or abnormal condition in living human subjects under controlled conditions.

Other medical sciences are concerned with studies of the causes, effects, prevention, or control of abnormal conditions in man or in his environment as they relate to health, except for the clinical aspects as defined above.

Life sciences, nec[1]

b. **Psychology** deals with behavior, mental processes, and individual and group characteristics and abilities. Psychology is divided into three categories: biological aspects, social aspects, and psychological sciences not elsewhere classified. Examples of the disciplines under each of these fields are

Biological aspects:

Experimental psychology; animal behavior; clinical psychology; comparative psychology; ethology.

Social aspects:

Social psychology; educational, personnel, vocational psychology and testing; industrial and engineering psychology; development and personality.

Psychological sciences, nec[1]

c. **Physical sciences** are concerned with the understanding of the material universe and its phenomena. They comprise the fields of astronomy, chemistry, physics, and physical sciences not elsewhere classified. Examples of the disciplines under each of these fields are

Astronomy:

Laboratory astrophysics; optical astronomy; radio astronomy; theoretical astrophysics; X-ray, Gamma-ray, neutrino astronomy.

Chemistry:

Inorganic; organo-metallic; organic; physical.

Physics:

Acoustics; atomic and molecular; condensed matter; elementary particle; nuclear structure; optics; plasma.

Physical sciences, nec[1]

d. **Environmental sciences** (terrestrial and extraterrestrial) are concerned with the gross nonbiological properties (with one exception) of the areas of the solar system that directly or indirectly affect man's survival and welfare; they comprise the fields of atmospheric sciences, geological sciences, oceanography, and environmental sciences not elsewhere classified. The one exception is studies pertaining to life in the sea, or other bodies of water, which are considered in support of oceanography and not biology.

Atmospheric sciences:

Aeronomy; solar; weather modification; extraterrestrial atmospheres; meteorology.

Geological sciences:

Engineering geophysics; general geology; geodesy and gravity; geomagnetism; hydrology; inorganic geochemistry; isotopic geochemistry; organic geochemistry; laboratory geophysics; paleomagnetism; paleontology; physical geography and cartography; seismology; soil sciences.

Oceanography:

Biological oceanography; chemical oceanography; physical oceanography; marine geophysics.

Environmental sciences, nec[1]

e. **Mathematics and computer sciences** employ logical reasoning with the aid of symbols and are concerned with the development of methods of operation employing such symbols, and in the case of computer sciences, with the application of such methods to automated information systems. Examples of disciplines under these fields are

Mathematics:

Algebra; analysis; applied mathematics; foundations and logic; geometry; numerical analysis; statistics; topology.

Computer sciences:

Programming languages; computer and information sciences (general); design, development, and application of computer capabilities to data storage and manipulation; information sciences and systems; systems analysis.

Mathematics and computer sciences, nec[1]

f. **Engineering** is concerned with studies directed toward developing engineering principles or toward making specific scientific principles usable in engineering practice. Engineering is divided into eight fields: aeronautical, astronautical, chemical, civil, electrical, mechanical, metallurgy and materials, and engineering not elsewhere classified. The following are examples of disciplines under each of these fields.

Aeronautical:

Aerodynamics.

Astronautical:

Aerospace; space technology.

Chemical:

Petroleum; petroleum refining; process.

Civil:

Architectural; hydraulic, hydrologic; marine; sanitary and environmental; structural; transportation.

Electrical:

Communication; electronic power.

Mechanical:

Engineering mechanics.

Metallurgy and materials:

Ceramic; mining; textile; welding.

Engineering, nec[1]

Agricultural; industrial and management; nuclear; ocean engineering; systems.

g. **Social sciences** are directed toward an understanding of the behavior of social institutions and groups and of individuals as members of a group. These sciences include anthropology, economics, political science, sociology, and social sciences not elsewhere classified. The following are examples of the disciplines under the fields of social science.

Anthropology:

Archaeology; cultural and personality; social and ethnology; applied anthropology.

Economics:

Econometrics and economic statistics; history of economic thought; international economics; industrial, labor, and agricultural economics; macroeconomics; microeconomics; public finance and fiscal policy; theory; economic systems and development.

Political science:

Area or regional studies; comparative government; history of political ideas; international relations and law; national political and legal systems; political theory; public administration.

Sociology:

Comparative and historical; complex organizations; culture and social structure; demography; group interactions, social problems and social welfare; sociological theory.

Social sciences, nec[1]

Linguistics; research in education; research in history; socio-economic geography; research in law, e.g., attempts to assess impact on society of legal systems and practices.

h. **Other sciences not elsewhere classified** include multidisciplinary and interdisciplinary projects that cannot be classified within one of the above broad fields of science.

[1] Not elsewhere classified. Includes multidisciplinary projects within the broad field and single-disciplinary projects for which a separate field has not been assigned.

82

83

8. Geographic Distribution of R&D Obligations, FY 1977

a. Ten agencies participated in the survey on the geographic distribution of obligations for research and development and R&D plant. These 10 respondents accounted for 98 percent of total Federal R&D and R&D plant obligations in 1977. The respondents were the Departments of Agriculture; Commerce; Defense; Energy; the Interior; Transportation; and Health, Education, and Welfare; the Environmental Protection Agency; the National Aeronautics and Space Administration; and the National Science Foundation.

b. Data for 1977 were requested in terms of the principal location (State or outlying area) where the work was performed by the prime contractor, grantee, or intramural organization. Where this information was not available in their records, the respondents were asked to assign the obligations to the State, outlying area, etc. where the prime contractor, grantee, or intramural organization was located.

c. Obligations were reported for research and development as a combined amount.

d. Specifically omitted from the survey were R&D obligations to foreign performers and obligations for R&D plant used in support of foreign performers.

CHANGES IN REPORTING

Responses from the agencies in this survey, as in the previous ones, reflect updating of estimates for the latest two years of the previous report. Such updating is normal in the budgetary cycle. In addition, from time to time responses have reflected reappraisals and revisions in classification of various phases of agencies' R&D programs. When this has occurred, NSF has required the agencies to revise prior-year data to maintain consistency and comparability with the most recent reporting. Since no statistical reporting system is free of problems of concepts and definitions for the respondents, revisions toward greater accuracy are encouraged by NSF.

LIMITATIONS OF THE DATA

Funds for research and development are reported on a 3-year basis comparable with the 1979 budget, upon which the data are based. The respondents have reconciled the data reported here with amounts for research and development shown in *The Budget of the United States Government, Fiscal Year 1979*. The amounts reported for each year are the obligations or outlays incurred in that year, regardless of when the funds were authorized or received by an agency and regardless of whether or not the funds were identified in the agency's budget specifically for research, development, and/or R&D plant.

Data submitted by the Federal agencies for 1977 are considered to be actual since they represent essentially completed transactions. Amounts reported for 1978 and 1979 are estimates in that they are subject to further appropriation, apportionment, or allocation decisions. The actual effects of those and other later actions on 1978 and 1979 outlays and obligations will be reflected in the next report.

It is important to bear in mind that judgment is often necessary in classifying the data. Because of the many-sided nature of R&D programs, it is difficult to establish consistent criteria for allocating efforts among the character-of-work categories and the various fields of science. Nonetheless, the participating agencies have developed increasingly consistent systems over the years for classifying R&D data. Revisions resulting from changes in an agency's reporting practices have been incorporated into the historical data to improve the comparability and consistency of the statistical series.

In some cases agencies have not found it possible to report the full cost of research and development. For example, the headquarters costs of planning and administering R&D programs of DOD and DOE are not included because these agencies have indicated that is is impracticable to identify the amounts.

R&D plant data reported here are to some extent understated because of the difficulty encountered by some agencies, particularly DOD and NASA, in identifying and reporting this information. While DOD reports obligations for R&D plant funded by its construction appropriation, DOD is able to identify only a small portion of the amount of R&D plant support included in R&D contracts that are funded from its RDT&E appropriation. NASA does not separately identify those portions of industrial R&D contracts applicable to R&D plant but includes R&D plant amounts in the R&D total for industrial performance.

RELATIONS TO OTHER REPORTS

1. Federal Support to Universities and Colleges

NSF publishes a separate report covering Federal support to individual colleges and universities. This report is based on data provided by the Federal agencies in response to the reporting system established by the Committee on Academic Science and Engineering (CASE) of the Federal Council for Science and Technology. This report is referred to in this publication as the Federal Support to Universities (or CASE) report.

Both the CASE and *Federal Funds* reports provide data on Federal obligations for research and development and R&D plant to universities and colleges and to university-administered federally funded research and development centers (FFRDC's). The CASE report, however, is based on obligations of Federal agencies to each individual academic institution, while the *Federal Funds* report is concerned with obligations to universities and colleges as a performer group. The CASE report also includes funds for non-R&D activities, such as science education and nonscience support. Further, the CASE study is based on reports of only 14 agencies (the Departments of Agriculture; Commerce; Defense; Energy; Health, Education, and Welfare; Housing and Urban Development; the Interior; Labor; and Transportation; the Environmental Protection Agency; the National Aeronautics and Space Administration; the National Science Foundation; the Agency for International Development; and the Nuclear Regulatory Commission) while *Federal Funds* is composed of obligations of all agencies. The 14 respondents for CASE account for more than 99 percent of the Federal R&D total to universities and colleges and all obligations to university-administered FFRDC's.

The different reporting procedures have led to different amounts being reported by CASE and *Federal Funds*, as follows:

a. The obligations for research and development to universities and colleges reported for *Federal Funds* in 1977 amounted to $2,886 million, or $114 million more than the amount reported for CASE. Part of this difference can be attributed to variations in the amounts reported by the National Institutes of Health (HEW). The *Federal Funds* R&D total for the National Institutes of Health included funds for General Research Support grants, whereas in CASE these were placed under the category of "general support for science," which is a non-R&D area under the CASE definition.

b. The R&D obligation total to university-administered FFRDC's reported to *Federal Funds* was $1,327 million in 1977, or $127 million less than reported for CASE. For *Federal Funds* $140 million subcontracted by NASA's Jet Propulsion Laboratory was included in ultimate-performer categories (mainly industry) while for CASE the subcontracted amount was included in the R&D obligations to FFRDC's administered by universities.

c. The total R&D plant obligations to universities and colleges reported for *Federal Funds* was $34 million in 1977, or $2 million less than the amount reported for CASE.

d. Total R&D plant obligations to FFRDC's administered by universities and colleges reported for *Federal Funds* were $278 million in 1977, or $120 million more than reported for CASE.

The following factors should also be considered in comparing the data appearing in the two reports:

For *Federal Funds* each agency includes in its own obligations the amounts transferred to other agencies for furtherance of its work, and the receiving agencies do not report funds transferred to them. On the other hand, in the CASE survey, the data are reported by the agency that makes the final distribution of the funds to a given institution. Thus, for the CASE survey, agencies included funds received from other agencies, and excluded funds transferred to other agencies, the reverse of

the *Federal Funds* process. While such transfers should balance each other out with no resulting changes in total R&D obligations, these varying reporting practices do add to the possibility of difference between the two reports.

The CASE reports, in most instances, are prepared by different operational units within each agency than those that prepare the *Federal Funds* responses. Furthermore, the CASE data are collected several months earlier than the *Federal Funds* statistics. Although, in theory, these conditions in themselves should not lead to reporting differences in practice differences do arise.

2. Special Analyses, Budget of the United States

In a section of *Special Analyses, Budget of the United States Government*, the Office of Management and Budget (OMB) publishes estimates of obligations and outlays for research, development, and R&D plant. However, the data in "Special Analysis P: Research and Development" in the 1979 budget do not provide as much detail on character of work or performers as *Federal Funds* and no information on fields of science or geographic distribution.

"Special Analysis P" and *Federal Funds* utilize the same definitions for research and development and for R&D plant. The estimates for research and development published in the two reports are comparable, even though minor differences exist. The differences between the two reports are as follows:

	Total R&D obligations (Billions of dollars)		
	FY 1977	*FY 1978*	*FY 1979*
Federal Funds	$23.9	$26.4	$28.0
Special Analysis P	23.8	26.3	27.9

3. An Analysis of Federal R&D Funding by Function, FY 1969-79

NSF published a report under the above title, providing an analysis of Federal R&D obligations by functional categories. *Federal Funds*, Volume XXVII, by contrast, reports on Federal R&D obligations by agencies but not by functional categories. The R&D obligation data for 1969-79 in the function report were based on information submitted by the agencies for the *Federal Funds* survey. Thus, the overall R&D obligations are the same in both reports for the same years covered.

4. Other Reports

a. Individual agencies may classify their R&D programs for purposes other than those for which the *Federal Funds* survey is conducted. Definitions and guidelines that are suitable to those other purposes may result in information that is not comparable with the data transmitted to the Foundation for *Federal Funds*.

b. *The Budget of the United States Government, Fiscal Year 1979* is the source of data on outlays, but the NSF definition of relatively uncontrollable outlays differs from that of OMB in that OMB designates outlays from prior-year contracts and obligations as relatively uncontrollable, whereas NSF considers this category of outlays to be initially controllable and therefore different in concept from fixed-cost and open-ended programs like social security, veterans compensation and pensions, and interest on the national debt.

The latter class of outlays are uncontrollable in that their disbursements fluctuate with the provisions of ongoing laws rather than with yearly appropriations. All outlays that require appropriation decisions by the Congress are considered by NSF to be relatively controllable; such outlays cover all R&D programs. See *The Budget, 1979*, p. 470.

SOURCES

Data on R&D funds in this report for years prior to 1952 were compiled by the Bureau of the Budget, and subsequent data were based on NSF surveys. These data have been published in previous issues of this series, but certain adjustments have been made to achieve comparability with the latest reporting concepts evolved by the agencies.

Supplementing the statistical data collected through the NSF survey of Federal agencies, a variety of sources were used for the text of this report, including the narrative statements submitted by the agencies in the NSF survey, published records of testimony presented by agencies to committees of the Senate and the House, the *1979 Budget Appendix*, and personal contacts with agency respondents.

APPENDIX B
Federally Funded Research and Development Centers, Fiscal Years 1977-79

Department of Defense

OFFICE OF THE SECRETARY OF DEFENSE

Administered by other nonprofit institutions:

Institute for Defense Analyses (IDA), Arlington, Virginia

DEPARTMENT OF THE NAVY

Administered by universities and colleges:

Applied Physics Laboratory (Johns Hopkins University),[1] Silver Spring, Maryland
Applied Research Laboratory (Pennsylvania State University), University Park, Pennsylvania
Center for Naval Analyses (University of Rochester), Arlington, Virginia

[1] No longer an FFRDC as of fiscal year 1978.

DEPARTMENT OF THE AIR FORCE

Administered by universities and colleges:

Lincoln Laboratory (Massachusetts Institute of Technology), Lexington, Massachusetts

Administered by other nonprofit institutions:

Aerospace Corporation, El Segundo, California
MITRE Corporation, Bedford, Massachusetts
Project Air Force (RAND Corporation), Santa Monica, California

Department of Health, Education, and Welfare

NATIONAL INSTITUTES OF HEALTH

Administered by industrial firms:

Frederick Cancer Research Center (Litton Bionetics, Inc., Litton Industries), Frederick, Maryland

Department of Energy

Administered by industrial firms:

Bettis Atomic Power Laboratory (Westinghouse Electric Corp.), Pittsburgh, Pennsylvania
Hanford Engineering Development Laboratory (Westinghouse-Hanford Corp.), Richland, Washington
Idaho National Engineering Laboratory (Aerojet Nuclear Corp.), Idaho Falls, Idaho
Knolls Atomic Power Laboratory (General Electric Company), Schenectady, New York
Liquid Metal Engineering Center (Rockwell International Corporation), Santa Susana, California
Mound Laboratory (Monsanto Research Corp.), Miamisburg, Ohio
Oak Ridge National Laboratory (Union Carbide Corp.), Oak Ridge, Tennessee
Sandia Laboratory (Western Electric Co., Inc.-Sandia Corp.), Albuquerque, New Mexico
Savannah River Laboratory (E.I. duPont de Nemours & Co., Inc.), Aiken, South Carolina

Administered by universities and colleges:

Ames Laboratory (Iowa State University of Science and Technology), Ames, Iowa
Argonne National Laboratory (University of Chicago and Argonne Universities Assn.), Argonne, Illinois
Brookhaven National Laboratory (Associated Universities, Inc.), Upton, Long Island, New York
E.O. Lawrence Berkeley Laboratory (University of California), Berkeley, California
E.O. Lawrence Livermore Laboratory (University of California), Livermore, California
Fermilab (Universities Research Association, Inc.) Batavia, Illinois
Los Alamos Scientific Laboratory (University of California), Los Alamos, New Mexico
Oak Ridge Institute of Nuclear Studies (Oak Ridge Associated Universities), Oak Ridge, Tennessee
Plasma Physics Laboratory (Princeton University), Princeton, New Jersey
Stanford Linear Accelerator Center (Stanford University), Stanford, California

Administered by other nonprofit institutions:

Pacific Northwest Laboratory (Battelle Memorial Institute), Richland, Washington
Solar Energy Research Institute (Midwest Research Institute),[1] Golden, Colorado

National Aeronautics and Space Administration

Administered by universities and colleges:

Jet Propulsion Laboratory (California Institute of Technology), Pasadena, California
Space Radiation Effects Laboratory (College of William and Mary), Williamsburg, Virginia

National Science Foundation

Administered by universities and colleges:

Cerro Tololo Inter-American Observatory (Association of Universities for Research in Astronomy, Inc.), La Serena, Chile
Kitt Peak National Observatory (Association of Universities for Research in Astronomy, Inc.), Tucson, Arizona
National Astronomy and Ionosphere Center (Cornell University), Arecibo, Puerto Rico
National Center for Atmospheric Research (University Corporation for Atmospheric Research), Boulder, Colorado
National Radio Astronomy Observatory (Associated Universities, Inc.), Green Bank, West Virginia
Sacramento Peak Observatory (Association of Universities for Research in Astronomy, Inc.),[1] Sunspot, New Mexico

[1] Established as an FFRDC in fiscal year 1978.

APPENDIX C

Listing of Statistical Tables and Summary Tables

RESEARCH, DEVELOPMENT, AND R&D PLANT

C-1. Overall summary: fiscal years 1977, 1978, and 1979 .....
C-2. By agency: fiscal years 1977, 1978, and 1979 .....

RESEARCH AND DEVELOPMENT—AGENCY, CHARACTER OF WORK, AND PERFORMER

C-3. By agency: fiscal years 1977, 1978, and 1979 ..
C-4. By agency and character of work: fiscal year 1977 .....
C-5. By agency and character of work: fiscal year 1978 (estimated) .....
C-6. By agency and character of work: fiscal year 1979 (estimated) .....
C-7. By agency and performer: fiscal year 1977 ...
C-8. By agency and performer: fiscal year 1978 (estimated) .....
C-9. By agency and performer: fiscal year 1979 estimated .....

TOTAL RESEARCH—AGENCY, PERFORMER, AND FIELD OF SCIENCE

C-10. By agency and performer: fiscal year 1977 ...
C-11. By agency and performer: fiscal year 1978 (estimated) .....
C-12. By agency and performer: fiscal year 1979 (estimated) .....
C-13 By detailed field of science: fiscal years 1977, 1978 and 1979 .....
C-14. By agency and field of science: fiscal year 1977 .....
C-15. By agency and field of science: fiscal year 1978 (estimated) .....
C-16. By agency and field of science: fiscal year 1979 (estimated) .....
C-17. Psychology and physical sciences, by agency and detailed field of science: fiscal year 1977
C-18. Psychology and physical sciences, by agency and detailed field of science: fiscal year 1978 (estimated) .....

C-19. Psychology and physical sciences, by agency and detailed field of science: fiscal year 1979 (estimated)
C-20. Life and environmental sciences, by agency and detailed field of science: fiscal year 1977
C-21. Life and environmental sciences, by agency and detailed field of science: fiscal year 1978 (estimated)
C-22. Life and environmental sciences, by agency and detailed field of science: fiscal year 1979 (estimated)
C-23. Engineering, by agency and detailed field of science: fiscal year 1977
C-24. Engineering, by agency and detailed field of science: fiscal year 1978 (estimated)
C-25. Engineering, by agency and detailed field of science: fiscal year 1979 (estimated)
C-26. Mathematics and computer sciences and social sciences, by agency and detailed field of science: fiscal year 1977
C-27. Mathematics and computer sciences and social sciences, by agency and detailed field of science: fiscal year 1978 (estimated)
C-28. Mathematics and computer sciences and social sciences, by agency and detailed field of science: fiscal year 1979 (estimated)

BASIC RESEARCH—AGENCY, PERFORMER, AND FIELD OF SCIENCE

C-29. By agency and performer: fiscal year 1977
C-30. By agency and performer: fiscal year 1978 (estimated)
C-31. By agency and performer: fiscal year 1979 (estimated)
C-32. By detailed field of science: fiscal years 1977, 1978, and 1979
C-33. By agency and field of science: fiscal year 1977
C-34. By agency and field of science: fiscal year 1978(estimated)
C-35. By agency and field of science: fiscal year 1979 (estimated)
C-36. Psychology and physical sciences, by agency and detailed field of science: fiscal year 1977
C-37. Psychology and physical sciences, by agency and detailed field of science: fiscal year 1978 (estimated)
C-38. Psychology and physical sciences, by agency and detailed field of science: fiscal year 1979 (estimated)

C-39. Life and environmental sciences by agency and detailed field of science: fiscal year 1977
C-40. Life and environmental; sciences, by agency and detailed field of science: fiscal year 1978 (estimated)
C-41. Life and environmental sciences, by agency and detailed field of science: fiscal year 1979 (estimated)
C-42. Engineering, by agency and detailed field of science: fiscal year 1977
C-43. Engineering, by agency and detailed field of science: fiscal year 1978 (estimated)
C-44. Engineering, by agency and detailed field of science: fiscal year 1979 (estimated)
C-45. Mathematics and computer sciences and social sciences, by agency and detailed field of science: fiscal year 1977
C-46. Mathematics and computer sciences and social sciences, by agency and detailed field of science: fiscal year 1978 (estimated)
C-47. Mathematics and computer sciences and social sciences, by agency and detailed field of science: fiscal year 1979 (estimated)

APPLIED RESEARCH—AGENCY, PERFORMER, AND FIELD OF SCIENCE

C-48. By agency and performer: fiscal year 1977
C-49. By agency and performer: fiscal year 1978 (estimated)
C-50. By agency and performer: fiscal year 1979 (estimated)
C-51. By detailed field of science: fiscal years 1977, 1978 and 1979
C-52. By agency and field of science: fiscal year 1977
C-53. By agency and field of science: fiscal year 1978 (estimated)
C-54. By agency and field of science: fiscal year 1979 (estimated)
C-55. Psychology and physical sciences, by agency and detailed field of science: fiscal year 1977 (estimated)
C-56. Psychology and physical sciences, by agency and detailed field of science: fiscal year 1978 (estimated)
C-57. Psychology and physical sciences, by agency and detailed field of science: fiscal year 1979 (estimted)
C-58. Life and environmental sciences, by agency and detailed field of science: fiscal year 1977 (estimated)

C-59. Life and environmental sciences, by agency and detailed field of science: fiscal year 1978 (estimated)
C-60. Life and environmental sciences, by agency and detailed field of science: fiscal year 1979 (estimated)
C-61. Engineering, by agency and detailed field of science: fiscal year 1977
C-62. Engineering, by agency and detailed field of science: fiscal year 1978 (estimated)
C-63. Engineering, by agency and detailed field of science: fiscal year 1979 (estimated)
C-64. Mathematics and computer sciences and social sciences, by agency and detailed field of science: fiscal year 1977
C-65. Mathematics and computer sciences and social sciences, by agency and detailed field of science: fiscal year 1978 (estimated)
C-66. Mathematics and computer sciences and social sciences, by agency and detailed field of science: fiscal year 1979 (estimated)

DEVELOPMENT—AGENCY AND PERFORMER

C-67. By agency and performer: fiscal year 1977
C-68. By agency and performer: fiscal year 1978 (estimated)
C-69. By agency and performer: fiscal year 1979 (estimated)

R&D PLANT

C-70. By agency: fiscal years 1977, 1978, and 1979
C-71. By agency and performer of the R&D the plant supports: fiscal year 1977
C-72. By agency and performer of the R&D the plant supports: fiscal year 1978 (estimated)
C-73. By agency and performer of the R&D the plant supports: fiscal year 1979 (estimated)

TOTAL RESEARCH PERFORMED AT UNIVERSITIES AND COLLEGES—AGENCY AND FIELD OF SCIENCE

C-74. By detailed field of science: fiscal years 1977, 1978, and 1979
C-75. By agency and field of science: fiscal year 1977
C-76. Psychology and physical sciences, by agency and detailed field of science: fiscal year 1977

C-77. Life and environmental sciences, by agency and detailed field of science: fiscal year 1977
C-78. Engineering, by agency and detailed field of science: fiscal year 1977
C-79. Mathematics and computer sciences and social sciences, by agency and detailed field of science: fiscal year 1977

BASIC RESEARCH PERFORMED AT UNIVERSITIES AND COLLEGES—AGENCY AND FIELD OF SCIENCE

C-80. By detailed field of science: fiscal years 1977, 1978, and 1979
C-81. By agency and field of science: 1977
C-82. Psychology and physical sciences, by agency and detailed field of science: fiscal year 1977
C-83. Life and environmental sciences, by agency and detailed field of science: fiscal year 1977
C-84. Engineering, by agency and detailed field of science: fiscal year 1977
C-85. Mathematics and computer sciences and social sciences, by agency and detailed field of science: fiscal year 1977

APPLIED RESEARCH PERFORMED AT UNIVERSITIES AND COLLEGES—AGENCY AND FIELD OF SCIENCE

C-86. By detailed field of science: fiscal years 1977, 1978, and 1979
C-87. By agency and field of science: fiscal year 1977
C-88. Psychology and physical sciences: by agency and detailed field of science, fiscal year 1977
C-89. Life and environmental sciences, by agency and detailed field of science: fiscal year 1977
C-90. Engineering, by agency and detailed field of science: fiscal year 1977
C-91. Mathematics and computer sciences and social sciences, by agency and detailed field of science: fiscal year 1977

FOREIGN PERFORMERS—RESEARCH AND DEVELOPMENT

C-92. By region, country, and agency: fiscal year 1977
C-93. By region, country, and agency: fiscal year 1978 (estimated)

FOREIGN PERFORMERS—BASIC RESEARCH

C-94. By region, country, and agency: fiscal year 1977
C-95. By region, country, and agency: fiscal year 1978 (estimated)

SPECIAL FOREIGN CURRENCY PROGRAM

C-96. For research and development, by agency: fiscal years 1977, 1978, and 1979
C-97. For basic research, by agency: fiscal year 1977, 1978, and 1979
C-98. For applied research by agency: fiscal years 1977, 1978, and 1979
C-99. For development, by agency: fiscal years 1977, 1978, and 1979.

GEOGRAPHIC DISTRIBUTION—RESEARCH AND DEVELOPMMENT AND R&D PLANT

C-100. Research, development, and R&D plant, by geographic divsion and State: fiscal year 1977
C-101. Research and development, by State and performer: fiscal year 1977
C-101A. Percent distribution to each performer, by State: fiscal year 1977
C-101B. Percent distribution to each State, by performer: fiscal year 1977
C-102. Research and development, by State and agency: fiscal year 1977
C-102A. Percent distribution of each agency, by State: fiscal year 1977
C-102B. Percent distribution of each State, by agency: fiscal year 1977.
C-103. Research and development, by geographic division, State, agency, and performer: fiscal year, 1977
C-104. R&D plant, by geographic division, State, and performer supported: fiscal year 1977
C-105. R&D plant, by geographic division, State, and agency: fiscal year 1977

FEDERAL INTRAMURAL PERSONNEL COSTS

C-106. Total research and development, by agency: fiscal years 1977, 1978, and 1979
C-107. Basic research, by agency: fiscal years 1977, 1978, and 1979
C-108. Applied research, by agency: fiscal years 1977, 1978, and 1979.
C-109. Development, by agency: fiscal years 1977, 1978, and 1979

HISTORICAL DATA

Outlays

C-110. Research, developmment, and R&D plant, by agency: fiscal years 1969-79
C-111. Research and development, by agency: fiscal years 1969-79
C-112. R&D plant, by agency: fiscal years 1969-79

Obligations

C-113. Research, development, and R&D plant, by agency: fiscal years 1969-79
C-114. Research and development, by agency: fiscal years 1969-79
C-115. R&D plant, by agency: fiscal years 1969-79
C-116. Research and development, by character of work and R&D plant: fiscal years 1969-79
C-117. Total research, by selected agency: fiscal years 1969-79
C-118. Basic research, by selected agency: fiscal years 1969-79
C-119. Applied research, by selected agency: fiscal years 1969-79
C-120. Development, by selected agency: fiscal years 1969-79
C-121. Research and development, by performer: fiscal years 1969-79
C-122. Total research, by performer: fiscal years 1969-79
C-123. Basic research, by performer: selected fiscal years 1969-79
C-124. Applied research, by performer: fiscal years 1969-79
C-125. Development by performer: fiscal years 1969-79
C-126. Total research, by field of science: fiscal years 1969-79
C-127. Basic research, by field of science: fiscal years 1969-79
C-128. Applied research, by field of science: fiscal years 1969-79
C-129. Research and development, by geographic division and State: fiscal years 1968-77
C-130. R&D plant, by geographic division and State: fiscal years 1968-77

NOTES

- The title of the statistical tables and the final report formerly was *Federal Funds for Research, Development, and Other Scientific Activities*
- Estimates for 1979 are based on *the Budget of the United States Government, Fiscal Year 1979* as submitted to Congress, and do not reflect subsequent appropriations and apportionment actions.
- Details may not add to totals because of rounding.
- Asterisks appearing in lieu of figures indicate that the amounts are less than $50,000.
- The abbreviation "FFRDC's" appearing in statistical tables refers to federally funded research and development centers.
- In tables showing extramural performers, obligations to agricultural experiment stations are included within obligations to universities and colleges.
- Defense Agencies within the Department of Defense include the Defense Advanced Research Projects Agency, the Defense Nuclear Agency, the Defense Communications Agency, the Defense Mapping Agency, the Defense Logistics Agency, the Uniformed Services University of the Health Sciences, and technical support, Joint Chiefs of Staff.
- Departmentwide funds of the Department of Defense cover the Defense Civil Preparedness Agency.
- R&D data reported by the National Aeronautics and Space Administration are in terms of budget plan rather than obligations.
- Within the Department of Agriculture the Economics, Statistics, and Cooperatives Service includes the former Economic Research Service, Farmer Cooperative Service, and Statistical Reporting Service. Under the Science and Education Administration, Federal Research replaces the former Agricultural Research Service, and Cooperative Research replaces the former Cooperative State Research Service.
- Within the Department of Commerce the National Telecommunications and Information Administration includes the former Office of Telecommunications within Commerce and the former Office of Telecommunications Policy.
- Within the Department of Health, Education, and Welfare the Social and Rehabilitation Service (SRS) has been disbanded, and the new Health Care Financing Administration includes health-related research formerly within SRS as well as health and medical insurance research formerly within the Social Security Adminstration (SSA). The public assistance research of SRS has been transferred to SSA and to the former Office of Human Development, which is now Human Development Services.
- The Department of Energy includes the former Energy Research and Development Administration, parts of the Bureau of Mines and the Bonneville Power Administration from the Department of the Interior, and the Federal Energy Administration.
- Within the Department of the Interior, the name of the Bureau of Outdoor Recreation has been changed to the Heritage Conservation and Recreation Service.
- These appendix tables (Volume XXVII) providing data on R&D totals for 1969 and 1971 through 1976 are not comparable with totals for those years in appendix tables issued to accompany earlier *Federal Funds* reports. For example, R&D plant totals have changed for 1976. Basic research and applied research totals for 1974 and development totals for 1975 and 1976 have also been changed. Performer totals for 1974 through 1976 are likewise not comparable with data in earlier appendix tables. Totals for fields of science for basic research and applied research have also been changed for 1974.

NOTE: For trend comparisons, use only these tables, Appendix C, for Volume XXVII and not any earlier ones.

TABLE C-1. SUMMARY OF FEDERAL FUNDS FOR RESEARCH, DEVELOPMENT, AND R&D PLANT: FISCAL YEARS 1977, 1978, AND 1979

(MILLIONS OF DOLLARS)

ITEM	ACTUAL, 1977	ESTIMATES 1978	ESTIMATES 1979
TOTAL OUTLAYS FOR RESEARCH, DEVELOPMENT, AND R&D PLANT	23,363.5	26,147.9	28,145.5
RESEARCH AND DEVELOPMENT	22,563.2	24,759.6	26,741.8
R&D PLANT	800.2	1,388.3	1,403.8
TOTAL OBLIGATIONS FOR RESEARCH, DEVELOPMENT, AND R&D PLANT	25,296.3	28,086.9	29,320.0
RESEARCH AND DEVELOPMENT	23,929.1	26,419.5	27,972.2
PERFORMERS:			
FEDERAL INTRAMURAL(1)	6,141.6	6,564.9	6,941.2
INDUSTRIAL FIRMS	11,125.3	12,432.2	13,314.5
FFRDCS ADMINISTERED BY INDUSTRIAL FIRMS	1,112.7	1,179.6	1,201.9
UNIVERSITIES AND COLLEGES	2,886.0	3,407.6	3,665.1
FFRDCS ADMINISTERED BY UNIVERSITIES AND COLLEGES	1,326.8	1,282.7	1,325.6
OTHER NONPROFIT INSTITUTIONS	782.0	893.2	888.0
FFRDCS ADMINISTERED BY NONPROFIT INSTITUTIONS	263.9	305.8	289.7
STATE AND LOCAL GOVERNMENTS	202.6	229.4	222.3
FOREIGN	88.2	124.0	123.9
RESEARCH	8,841.2	9,857.5	10,482.7
PERFORMERS:			
FEDERAL INTRAMURAL(1)	3,037.0	3,259.8	3,413.4
INDUSTRIAL FIRMS	1,613.6	1,910.0	2,062.8
FFRDCS ADMINISTERED BY INDUSTRIAL FIRMS	199.4	229.9	255.3
UNIVERSITIES AND COLLEGES	2,612.4	2,962.6	3,218.9
FFRDCS ADMINISTERED BY UNIVERSITIES AND COLLEGES	671.2	662.9	696.2
OTHER NONPROFIT INSTITUTIONS	508.9	600.5	600.3
FFRDCS ADMINISTERED BY NONPROFIT INSTITUTIONS	55.5	56.4	54.0
STATE AND LOCAL GOVERNMENTS	84.5	98.8	99.1
FOREIGN	58.7	76.7	83.0
FIELDS OF SCIENCE:			
LIFE SCIENCES	3,019.4	3,382.9	3,506.9
PSYCHOLOGY	159.1	177.9	200.3
PHYSICAL SCIENCES	1,510.6	1,695.9	1,818.7
ENVIRONMENTAL SCIENCES	921.0	1,011.8	1,109.5
MATHEMATICS AND COMPUTER SCIENCES	176.3	197.9	230.3
ENGINEERING	2,425.9	2,665.0	2,791.3
SOCIAL SCIENCES	443.3	530.0	556.9
OTHER SCIENCES NEC	185.5	196.1	268.7
BASIC RESEARCH	2,894.1	3,292.3	3,636.7
PERFORMERS:			
FEDERAL INTRAMURAL(1)	866.2	975.3	1,046.2
INDUSTRIAL FIRMS	186.7	227.7	268.6
FFRDCS ADMINISTERED BY INDUSTRIAL FIRMS	47.7	49.8	54.5
UNIVERSITIES AND COLLEGES	1,314.5	1,508.9	1,697.0
FFRDCS ADMINISTERED BY UNIVERSITIES AND COLLEGES	323.4	346.0	373.0
OTHER NONPROFIT INSTITUTIONS	121.8	142.4	151.4
FFRDCS ADMINISTERED BY NONPROFIT INSTITUTIONS	5.3	5.8	6.3
STATE AND LOCAL GOVERNMENTS	11.2	13.2	15.2
FOREIGN	17.4	23.4	24.4
FIELDS OF SCIENCE:			
LIFE SCIENCES	1,020.7	1,167.3	1,299.3
PSYCHOLOGY	54.2	63.8	74.1
PHYSICAL SCIENCES	873.8	978.1	1,067.9
ENVIRONMENTAL SCIENCES	456.1	511.9	566.7
MATHEMATICS AND COMPUTER SCIENCES	79.3	88.8	101.3
ENGINEERING	303.1	345.5	374.3
SOCIAL SCIENCES	94.5	117.2	128.5
OTHER SCIENCES NEC	12.3	19.7	24.6
APPLIED RESEARCH	5,947.1	6,565.2	6,845.9
PERFORMERS:			
FEDERAL INTRAMURAL(1)	2,170.8	2,284.6	2,367.2
INDUSTRIAL FIRMS	1,426.9	1,682.3	1,794.2
FFRDCS ADMINISTERED BY INDUSTRIAL FIRMS	151.7	180.0	200.9
UNIVERSITIES AND COLLEGES	1,297.9	1,453.8	1,521.8
FFRDCS ADMINISTERED BY UNIVERSITIES AND COLLEGES	347.9	316.9	323.1
OTHER NONPROFIT INSTITUTIONS	387.2	458.1	448.5
FFRDCS ADMINISTERED BY NONPROFIT INSTITUTIONS	50.2	50.6	47.7
STATE AND LOCAL GOVERNMENTS	73.3	85.6	83.9
FOREIGN	41.2	53.3	58.6
FIELDS OF SCIENCE:			
LIFE SCIENCES	1,998.7	2,215.6	2,207.6
PSYCHOLOGY	104.9	114.1	126.2
PHYSICAL SCIENCES	636.7	717.9	750.8
ENVIRONMENTAL SCIENCES	464.9	499.9	542.8
MATHEMATICS AND COMPUTER SCIENCES	97.0	109.1	129.0
ENGINEERING	2,122.8	2,319.5	2,416.9
SOCIAL SCIENCES	348.8	412.9	428.4
OTHER SCIENCES NEC	173.2	176.4	244.1

CONTINUED ON NEXT PAGE

TABLE C-1. SUMMARY OF FEDERAL FUNDS FOR RESEARCH, DEVELOPMENT, AND R&D PLANT: FISCAL YEARS 1977, 1978, AND 1979

- CONTINUED

(MILLIONS OF DOLLARS)

ITEM	ACTUAL, 1977	ESTIMATES 1978	ESTIMATES 1979
DEVELOPMENT	15,087.9	16,561.9	17,489.5
PERFORMERS:			
FEDERAL INTRAMURAL(1)	3,104.6	3,305.0	3,527.7
INDUSTRIAL FIRMS	9,511.7	10,522.2	11,251.8
FFRDCS ADMINISTERED BY INDUSTRIAL FIRMS	913.3	949.7	946.5
UNIVERSITIES AND COLLEGES	273.7	445.0	446.2
FFRDCS ADMINISTERED BY UNIVERSITIES AND COLLEGES	655.6	619.8	629.5
OTHER NONPROFIT INSTITUTIONS	273.1	292.7	288.0
FFRDCS ADMINISTERED BY NONPROFIT INSTITUTIONS	208.4	249.4	235.8
STATE AND LOCAL GOVERNMENTS	118.2	130.7	123.2
FOREIGN	29.5	47.4	40.8
R&D PLANT	1,367.2	1,667.4	1,347.9
PERFORMERS SUPPORTED:			
FEDERAL INTRAMURAL	711.9	642.0	467.2
INDUSTRIAL FIRMS	103.4	298.8	231.4
FFRDCS ADMINISTERED BY INDUSTRIAL FIRMS	215.8	259.9	181.5
UNIVERSITIES AND COLLEGES	33.7	53.0	60.5
FFRDCS ADMINISTERED BY UNIVERSITIES AND COLLEGES	277.8	399.6	391.8
OTHER NONPROFIT INSTITUTIONS	6.7	4.8	6.9
FFRDCS ADMINISTERED BY NONPROFIT INSTITUTIONS	6.1	6.8	7.1
STATE AND LOCAL GOVERNMENTS	.6	2.2	.9
FOREIGN	11.2	.4	.6

(1) COSTS ASSOCIATED WITH THE ADMINISTRATION OF INTRAMURAL AND EXTRAMURAL PROGRAMS ARE COVERED AS WELL AS ACTUAL INTRAMURAL PERFORMANCE.

SOURCE: NATIONAL SCIENCE FOUNDATION.

TABLE C-2. FEDERAL FUNDS FOR RESEARCH, DEVELOPMENT, AND R&D PLANT, BY AGENCY: FISCAL YEARS 1977, 1978, AND 1979

(MILLIONS OF DOLLARS)

AGENCY AND SUBDIVISION	OBLIGATIONS			OUTLAYS		
	1977	ESTIMATES		1977	ESTIMATES	
		1978	1979		1978	1979
TOTAL, ALL AGENCIES	25,296.3	28,086.9	29,320.0	23,363.5	26,147.9	28,145.5
DEPARTMENTS						
DEPARTMENT OF AGRICULTURE, TOTAL	559.9	665.1	651.2	537.8	640.1	609.3
ECONOMICS, STATISTICS, AND COOPERATIVES SERVICE	30.5	34.8	35.8	30.5	34.7	35.8
FOREST SERVICE	92.1	109.1	102.9	92.5	107.9	92.6
SCIENCE AND EDUCATION ADMINISTRATION	437.3	521.2	512.6	414.7	497.5	477.0
COOPERATIVE RESEARCH	127.3	157.7	157.6	120.2	151.5	155.4
FEDERAL RESEARCH	310.1	363.5	355.0	294.6	346.0	321.6
DEPARTMENT OF COMMERCE, TOTAL	251.8	296.9	319.3	238.2	277.0	301.4
BUREAU OF THE CENSUS	2.6	3.3	3.8	2.5	3.3	3.7
ECONOMIC DEVELOPMENT ADMINISTRATION	15.0	37.1	40.1	20.0	24.5	27.5
MARITIME ADMINISTRATION	19.7	22.6	19.0	18.6	23.9	19.0
NATIONAL BUREAU OF STANDARDS	53.9	57.0	66.2	53.1	52.4	61.1
NATIONAL FIRE PREVENTION AND CONTROL ADMINISTRATION	6.6	7.1	8.0	6.6	7.5	7.9
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	147.2	162.8	175.0	132.6	160.5	175.0
NATIONAL TELECOMMUNICATIONS & INFORMATION ADMINISTRATION	2.9	2.6	3.2	2.5	2.3	2.8
OFFICE OF MINORITY BUSINESS ENTERPRISE	3.4	4.0	3.6	1.6	2.1	3.9
PATENT AND TRADEMARK OFFICE	.5	.5	.5	.5	.5	.5
DEPARTMENT OF DEFENSE, TOTAL	11,409.0	12,125.8	13,052.1	10,308.0	11,381.6	12,408.8
DEPARTMENT OF THE ARMY	2,458.2	2,635.0	2,871.0	2,195.0	2,448.9	2,735.9
MILITARY FUNCTIONS	2,434.3	2,609.0	2,843.2	2,171.2	2,422.8	2,708.1
RDT&E APPROPRIATIONS	2,330.8	2,477.7	2,706.2	2,069.2	2,304.0	2,575.0
PAY AND ALLOWANCES OF MILITARY PERSONNEL IN R&D	88.8	100.2	101.0	88.8	100.2	101.0
MILITARY CONSTRUCTION	14.7	31.1	36.0	13.2	18.6	32.1
CIVIL FUNCTIONS	23.9	26.1	27.8	23.9	26.1	27.8
DEPARTMENT OF THE NAVY	3,878.6	4,117.5	4,596.8	3,582.6	3,910.7	4,304.2
RDT&E APPROPRIATIONS	3,776.6	4,006.0	4,471.0	3,480.5	3,800.0	4,184.0
PAY AND ALLOWANCES OF MILITARY PERSONNEL IN R&D	80.7	95.6	96.0	80.7	95.6	96.0
MILITARY CONSTRUCTION	18.5	12.5	21.4	18.5	12.5	21.4
SPECIAL FOREIGN CURRENCY PROGRAM	2.8	3.4	8.4	2.9	2.6	2.8
DEPARTMENT OF THE AIR FORCE	4,381.1	4,579.2	4,660.6	3,902.2	4,336.5	4,509.3
RDT&E APPROPRIATIONS	3,825.2	4,169.7	4,398.3	3,618.5	3,927.0	4,247.0
PAY AND ALLOWANCES OF MILITARY PERSONNEL IN R&D	243.7	263.0	256.3	243.7	263.0	256.3
MILITARY CONSTRUCTION	312.2	146.5	6.0	40.0	146.5	6.0
DEFENSE AGENCIES	659.5	760.3	891.4	610.5	664.0	828.0
RDT&E APPROPRIATIONS	659.5	760.3	891.4	610.5	664.0	828.0
DEPARTMENTWIDE FUNDS	1.3	6.9	5.2	1.2	2.8	4.4
DIRECTOR OF TEST AND EVALUATION, DEFENSE	30.2	27.0	27.0	16.5	19.9	27.0
DEPARTMENT OF ENERGY	4,097.2	5,135.2	4,965.7	3,593.1	4,441.3	4,797.0
DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE, TOTAL	2,920.0	3,219.5	3,323.4	2,622.2	3,001.9	3,228.4
ALCOHOL, DRUG ABUSE AND MENTAL HEALTH ADMINISTRATION	153.0	163.4	203.2	167.2	173.1	198.9
CENTER FOR DISEASE CONTROL	55.3	62.7	63.1	42.6	52.9	57.6
FOOD AND DRUG ADMINISTRATION	43.7	51.8	50.4	28.6	27.7	31.3
HEALTH CARE FINANCING ADMINISTRATION	30.0	35.1	38.6	30.0	35.1	38.6
HEALTH RESOURCES ADMINISTRATION	7.4	5.0	-	1.4	2.3	-
HEALTH SERVICES ADMINISTRATION	17.7	17.0	17.2	15.6	15.4	15.7
HUMAN DEVELOPMENT SERVICES	76.8	79.0	85.7	80.0	79.4	82.7
NATIONAL INSTITUTE OF EDUCATION	64.9	84.6	94.4	59.7	73.6	84.8
NATIONAL INSTITUTES OF HEALTH	2,375.7	2,605.1	2,657.4	2,105.0	2,457.9	2,614.8
OFFICE OF EDUCATION	31.1	32.4	33.1	30.3	31.2	32.1
OFFICE OF THE ASSISTANT SECRETARY FOR EDUCATION	1.0	1.0	1.0	1.7	1.6	1.6
OFFICE OF THE ASSISTANT SECRETARY FOR HEALTH	32.2	39.5	37.2	28.1	13.5	28.9
OFFICE OF THE SECRETARY	20.0	30.0	27.0	21.3	25.9	27.6
SOCIAL SECURITY ADMINISTRATION	11.2	13.1	15.1	10.9	12.2	13.8
DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT	52.1	68.5	69.0	69.0	66.6	64.0
DEPARTMENT OF THE INTERIOR, TOTAL	301.2	390.2	362.4	287.8	352.8	361.9
BUREAU OF LAND MANAGEMENT	.9	1.2	1.1	.9	1.2	1.1
BUREAU OF MINES	105.3	130.6	103.0	103.7	106.8	110.8
BUREAU OF RECLAMATION	9.9	11.6	7.2	10.1	12.0	7.2
GEOLOGICAL SURVEY	128.9	162.6	173.5	123.2	160.8	171.5
HERITAGE CONSERVATION AND RECREATION SERVICE	*	-	-	*	-	-
NATIONAL PARK SERVICE	7.8	9.9	10.5	7.6	9.6	10.2
OFFICE OF SURFACE MINING RECLAMATION AND ENFORCEMENT	-	7.8	2.7	-	3.0	2.0
OFFICE OF THE SECRETARY	4.5	3.3	2.5	1.0	3.2	2.3
OFFICE OF WATER RESEARCH AND TECHNOLOGY	16.0	26.7	28.9	14.2	20.9	25.1
UNITED STATES FISH AND WILDLIFE SERVICE	27.8	36.6	33.0	27.1	35.2	31.5

CONTINUED ON NEXT PAGE

TABLE C-2. FEDERAL FUNDS FOR RESEARCH, DEVELOPMENT, AND R&D PLANT, BY AGENCY: FISCAL YEARS 1977, 1978, AND 1979

(MILLIONS OF DOLLARS)

- CONTINUED

AGENCY AND SUBDIVISION	OBLIGATIONS			OUTLAYS		
	1977	ESTIMATES 1978	ESTIMATES 1979	1977	ESTIMATES 1978	ESTIMATES 1979
DEPARTMENT OF JUSTICE, TOTAL	27.7	67.5	42.1	33.7	43.5	41.0
BUREAU OF PRISONS	1.1	3.4	3.0	1.0	2.3	3.1
DRUG ENFORCEMENT ADMINISTRATION	3.0	5.8	2.3	3.8	3.7	2.3
FEDERAL BUREAU OF INVESTIGATION	1.4	1.8	1.3	1.1	2.6	1.4
IMMIGRATION AND NATURALIZATION SERVICE	.3	.6	.4	.2	.6	.4
LAW ENFORCEMENT ASSISTANCE ADMINISTRATION	21.8	53.9	33.1	27.6	32.7	32.2
OFFICE OF THE ATTORNEY GENERAL	-	2.0	2.0	-	1.6	1.6
DEPARTMENT OF LABOR, TOTAL	29.6	32.2	32.1	28.1	32.1	31.9
BUREAU OF LABOR STATISTICS	1.4	1.2	.9	1.4	1.2	.9
EMPLOYMENT AND TRAINING ADMINISTRATION	16.8	17.7	14.3	16.8	17.7	14.3
EMPLOYMENT STANDARDS ADMINISTRATION	4.4	5.6	5.6	4.3	5.6	5.6
LABOR-MANAGEMENT SERVICES ADMINISTRATION	3.3	3.0	3.1	1.9	2.9	2.9
OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION	3.4	4.5	6.5	3.4	4.5	6.5
OFFICE OF THE SECRETARY	.2	.2	1.7	.2	.2	1.7
DEPARTMENT OF STATE, TOTAL	77.6	63.7	90.3	44.1	66.6	88.6
DEPARTMENTAL FUNDS	2.3	2.9	2.8	2.3	2.9	2.8
AGENCY FOR INTERNATIONAL DEVELOPMENT	75.3	60.8	87.5	41.8	63.6	85.9
DEPARTMENT OF TRANSPORTATION, TOTAL	377.1	437.1	392.8	363.5	398.6	387.4
FEDERAL AVIATION ADMINISTRATION	106.4	130.6	106.9	102.8	125.7	110.9
FEDERAL HIGHWAY ADMINISTRATION	55.9	56.1	58.9	53.0	56.5	64.8
FEDERAL RAILROAD ADMINISTRATION	58.5	75.9	55.7	57.3	63.8	53.0
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION	47.2	48.3	52.9	49.5	51.2	51.2
OFFICE OF THE SECRETARY	28.0	35.3	15.9	31.8	31.2	19.5
RESEARCH AND SPECIAL PROGRAM DIRECTORATE	-	.9	13.9	-	.9	9.4
UNITED STATES COAST GUARD	19.5	20.0	20.0	17.0	18.0	18.0
URBAN MASS TRANSPORTATION ADMINISTRATION	61.6	70.0	68.6	52.1	51.3	60.6
DEPARTMENT OF THE TREASURY, TOTAL	4.9	6.9	7.8	5.0	6.7	8.1
BUREAU OF ALCOHOL, TOBACCO AND FIREARMS	1.1	2.3	2.6	1.1	2.3	2.6
BUREAU OF ENGRAVING AND PRINTING	2.5	2.7	3.2	2.5	2.7	3.2
CUSTOMS SERVICE	1.3	1.9	2.1	1.4	1.7	2.3
OTHER AGENCIES						
ACTION	.5	1.3	5.6	.4	1.0	4.3
ADVISORY COMMISSION ON INTERGOVERNMENTAL RELATIONS	1.5	1.7	1.7	1.3	1.6	1.7
APPALACHIAN REGIONAL COMMISSION	.7	.8	.8	.6	.8	.8
CIVIL AERONAUTICS BOARD	.5	.7	.8	.5	.7	.8
CIVIL SERVICE COMMISSION	3.9	4.3	4.3	3.9	4.3	4.3
COMMUNITY SERVICES ADMINISTRATION	24.0	21.5	27.0	21.0	14.5	24.0
CONSUMER PRODUCT SAFETY COMMISSION	6.7	4.6	5.0	6.8	4.8	4.7
ENVIRONMENTAL PROTECTION AGENCY	297.6	334.3	332.6	283.0	312.6	315.7
FEDERAL COMMUNICATIONS COMMISSION	2.0	3.0	3.4	1.9	2.7	3.2
FEDERAL HOME LOAN BANK BOARD	1.7	1.1	1.3	1.7	1.1	1.3
FEDERAL TRADE COMMISSION	1.1	1.3	1.3	1.1	1.3	1.3
GENERAL SERVICES ADMINISTRATION	.9	2.2	1.1	.9	2.2	1.1
INTERNATIONAL COMMUNICATION AGENCY	.1	.2	.1	.1	.2	.1
INTERSTATE COMMERCE COMMISSION	.1	.2	.1	.1	.2	.1
LIBRARY OF CONGRESS	3.8	4.3	4.7	3.6	4.4	4.6
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION	3,821.5	4,038.8	4,345.0	3,945.3	3,981.6	4,270.1
NATIONAL SCIENCE FOUNDATION	724.1	790.2	867.6	674.7	749.8	784.7
NUCLEAR REGULATORY COMMISSION	119.4	140.0	163.5	107.8	130.5	153.0
SMALL BUSINESS ADMINISTRATION	.5	-	.1	.5	-	.1
SMITHSONIAN INSTITUTION	29.8	33.3	34.6	30.1	32.8	34.6
TENNESSEE VALLEY AUTHORITY	30.2	66.0	83.7	30.2	66.0	83.7
UNITED STATES ARMS CONTROL AND DISARMAMENT AGENCY	2.2	2.6	3.7	2.2	2.6	3.4
UNITED STATES INTERNATIONAL TRADE COMMISSION	2.6	2.6	2.7	2.6	2.6	2.7
VETERANS ADMINISTRATION	112.9	123.1	121.4	112.8	121.0	121.4

• INDICATES AMOUNT LESS THAN $50,000.

SOURCE: NATIONAL SCIENCE FOUNDATION.

TABLE C-3. FEDERAL FUNDS FOR TOTAL RESEARCH AND DEVELOPMENT, BY AGENCY: FISCAL YEARS 1977, 1978, AND 1979

(MILLIONS OF DOLLARS)

AGENCY AND SUBDIVISION	OBLIGATIONS			OUTLAYS		
	1977	ESTIMATES		1977	ESTIMATES	
		1978	1979		1978	1979
TOTAL, ALL AGENCIES	23,929.1	26,419.5	27,972.2	22,563.2	24,759.6	26,741.8
DEPARTMENTS						
DEPARTMENT OF AGRICULTURE, TOTAL	547.0	632.5	636.0	515.3	603.6	583.6
ECONOMICS, STATISTICS, AND COOPERATIVES SERVICE	30.5	34.8	35.8	30.5	34.7	35.8
FOREST SERVICE	90.3	106.5	102.9	89.0	104.4	91.8
SCIENCE AND EDUCATION ADMINISTRATION	426.2	491.2	497.4	395.7	464.4	456.0
COOPERATIVE RESEARCH	127.3	157.7	157.6	120.1	151.5	155.4
FEDERAL RESEARCH	298.9	333.5	339.8	275.6	313.0	300.7
DEPARTMENT OF COMMERCE, TOTAL	244.7	287.7	315.1	232.5	269.6	297.3
BUREAU OF THE CENSUS	2.6	3.3	3.8	2.5	3.3	3.7
ECONOMIC DEVELOPMENT ADMINISTRATION	15.0	37.1	40.1	20.0	24.5	27.5
MARITIME ADMINISTRATION	14.8	17.7	15.0	15.1	20.2	16.0
NATIONAL BUREAU OF STANDARDS	53.2	55.0	66.0	52.6	51.0	60.0
NATIONAL FIRE PREVENTION AND CONTROL ADMINISTRATION	6.6	7.1	8.0	4.6	7.5	7.9
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	145.7	160.5	175.0	131.2	158.2	175.0
NATIONAL TELECOMMUNICATIONS & INFORMATION ADMINISTRATION	2.9	2.6	3.2	2.5	2.3	2.8
OFFICE OF MINORITY BUSINESS ENTERPRISE	3.4	4.0	3.6	1.6	2.1	3.9
PATENT AND TRADEMARK OFFICE		.5	.5	.5	.5	.5
DEPARTMENT OF DEFENSE, TOTAL	10,963.4	11,824.7	12,837.7	10,182.4	10,982.9	12,047.5
DEPARTMENT OF THE ARMY	2,441.9	2,602.1	2,833.1	2,180.2	2,428.5	2,701.9
MILITARY FUNCTIONS	2,418.0	2,576.1	2,805.3	2,156.4	2,402.4	2,674.1
RDT&E APPROPRIATIONS	2,329.2	2,475.9	2,704.3	2,067.6	2,302.2	2,573.1
PAY AND ALLOWANCES OF MILITARY PERSONNEL IN R&D	88.8	100.2	101.0	88.8	100.2	101.0
CIVIL FUNCTIONS	23.9	26.1	27.8	23.9	26.1	27.8
DEPARTMENT OF THE NAVY	3,817.4	4,056.6	4,501.9	3,519.0	3,845.5	4,216.0
RDT&E APPROPRIATIONS	3,733.9	3,957.6	4,397.5	3,435.4	3,747.3	4,117.2
PAY AND ALLOWANCES OF MILITARY PERSONNEL IN R&D	80.7	95.6	96.0	80.7	95.6	96.0
SPECIAL FOREIGN CURRENCY PROGRAM	2.8	3.4	8.4	2.9	2.6	2.8
DEPARTMENT OF THE AIR FORCE	4,031.1	4,399.2	4,615.6	3,862.2	4,036.5	4,287.3
RDT&E APPROPRIATIONS	3,787.4	4,136.2	4,359.3	3,618.5	3,773.5	4,031.0
PAY AND ALLOWANCES OF MILITARY PERSONNEL IN R&D	243.7	263.0	256.3	243.7	263.0	256.3
DEFENSE AGENCIES	641.4	733.0	854.8	603.3	650.9	810.9
RDT&E APPROPRIATIONS	641.4	733.0	854.8	603.3	650.9	810.9
DEPARTMENTWIDE FUNDS	1.3	6.9	5.2	1.2	2.5	4.4
DIRECTOR OF TEST AND EVALUATION, DEFENSE	30.2	27.0	27.0	16.5	19.0	27.0
DEPARTMENT OF ENERGY	3,536.2	4,195.8	4,175.0	3,166.0	3,849.4	4,136.3
DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE, TOTAL	2,787.3	3,131.5	3,271.1	2,576.6	2,907.9	3,142.8
ALCOHOL, DRUG ABUSE AND MENTAL HEALTH ADMINISTRATION	153.0	163.0	203.2	167.2	173.0	198.7
CENTER FOR DISEASE CONTROL	55.3	62.7	63.1	42.6	52.9	57.6
FOOD AND DRUG ADMINISTRATION	42.9	48.6	49.1	24.4	26.0	26.5
HEALTH CARE FINANCING ADMINISTRATION	30.0	35.1	38.6	30.0	35.1	38.6
HEALTH RESOURCES ADMINISTRATION	7.4	5.0	-	1.4	2.3	-
HEALTH SERVICES ADMINISTRATION	17.7	17.0	17.2	15.6	15.4	15.7
HUMAN DEVELOPMENT SERVICES	76.8	79.0	85.7	80.0	79.4	82.7
NATIONAL INSTITUTE OF EDUCATION	64.9	84.6	94.4	59.7	73.6	84.8
NATIONAL INSTITUTES OF HEALTH	2,243.9	2,520.6	2,606.3	2,063.7	2,365.6	2,534.2
OFFICE OF EDUCATION	31.1	32.4	33.1	30.3	31.2	32.1
OFFICE OF THE ASSISTANT SECRETARY FOR EDUCATION	1.0	1.0	1.0	1.7	1.6	1.6
OFFICE OF THE ASSISTANT SECRETARY FOR HEALTH	32.2	39.5	37.2	28.1	13.5	28.9
OFFICE OF THE SECRETARY	20.0	30.0	27.0	21.3	25.9	27.6
SOCIAL SECURITY ADMINISTRATION	11.2	13.1	15.1	10.9	12.2	13.8
DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT	52.1	68.5	69.0	69.0	66.6	64.0
DEPARTMENT OF THE INTERIOR, TOTAL	296.3	372.3	359.4	283.3	339.4	357.1
BUREAU OF LAND MANAGEMENT	.9	1.2	1.1	.9	1.2	1.1
BUREAU OF MINES	101.9	121.3	103.0	100.7	101.5	108.5
BUREAU OF RECLAMATION	9.9	11.6	7.2	10.1	12.0	7.2
GEOLOGICAL SURVEY	128.9	162.6	173.5	123.2	160.8	171.5
HERITAGE CONSERVATION AND RECREATION SERVICE	*	-	-	*	-	-
NATIONAL PARK SERVICE	7.8	9.9	10.5	7.6	9.6	10.2
OFFICE OF SURFACE MINING RECLAMATION AND ENFORCEMENT	-	7.8	2.7	-	3.0	2.0
OFFICE OF THE SECRETARY	4.5	3.3	2.5	1.0	3.2	2.3
OFFICE OF WATER RESEARCH AND TECHNOLOGY	15.1	25.6	27.7	13.3	19.9	23.9
UNITED STATES FISH AND WILDLIFE SERVICE	27.2	29.1	31.3	26.5	28.2	30.2

CONTINUED ON NEXT PAGE

TABLE C-3. FEDERAL FUNDS FOR TOTAL RESEARCH AND DEVELOPMENT, BY AGENCY: FISCAL YEARS 1977, 1978, AND 1979

- CONTINUED

(MILLIONS OF DOLLARS)

AGENCY AND SUBDIVISION	OBLIGATIONS			OUTLAYS		
	1977	ESTIMATES		1977	ESTIMATES	
		1978	1979		1978	1979
DEPARTMENT OF JUSTICE, TOTAL	27.7	67.5	42.1	33.7	43.5	41.0
BUREAU OF PRISONS	1.1	3.4	3.0	1.0	2.3	3.1
DRUG ENFORCEMENT ADMINISTRATION	3.0	5.8	2.3	3.8	3.7	2.3
FEDERAL BUREAU OF INVESTIGATION	1.4	1.8	.3	1.1	2.6	1.4
IMMIGRATION AND NATURALIZATION SERVICE	.3	.6	.4	.2	.6	.4
LAW ENFORCEMENT ASSISTANCE ADMINISTRATION	21.8	53.9	33.1	27.6	32.7	32.2
OFFICE OF THE ATTORNEY GENERAL	-	2.0	2.0	-	1.6	1.6
DEPARTMENT OF LABOR, TOTAL	29.6	32.2	32.1	28.1	32.1	31.9
BUREAU OF LABOR STATISTICS	1.4	1.2	.9	1.4	1.2	.9
EMPLOYMENT AND TRAINING ADMINISTRATION	16.8	17.7	14.3	16.8	17.7	14.3
EMPLOYMENT STANDARDS ADMINISTRATION	4.4	5.6	5.6	4.3	5.6	5.6
LABOR-MANAGEMENT SERVICES ADMINISTRATION	3.3	3.0	3.1	1.9	2.9	2.9
OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION	3.4	4.5	6.5	3.4	4.5	6.5
OFFICE OF THE SECRETARY	.2	.2	1.7	.2	.2	1.7
DEPARTMENT OF STATE, TOTAL	61.4	62.9	84.4	40.1	62.6	81.6
DEPARTMENTAL FUNDS	2.3	2.9	2.8	2.3	2.9	2.8
AGENCY FOR INTERNATIONAL DEVELOPMENT	59.1	60.0	81.7	37.8	59.6	78.9
DEPARTMENT OF TRANSPORTATION, TOTAL	354.6	407.5	372.2	346.0	374.0	369.0
FEDERAL AVIATION ADMINISTRATION	103.4	121.0	106.3	99.8	117.1	109.4
FEDERAL HIGHWAY ADMINISTRATION	55.5	55.7	57.6	52.6	56.1	63.5
FEDERAL RAILROAD ADMINISTRATION	41.9	59.0	39.7	45.6	50.8	40.0
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION	47.0	48.1	52.7	49.3	51.0	51.0
OFFICE OF THE SECRETARY	28.0	35.3	15.9	31.8	31.2	19.5
RESEARCH AND SPECIAL PROGRAM DIRECTORATE	-	.9	13.9	-	.9	9.4
UNITED STATES COAST GUARD	18.9	19.2	19.2	16.5	17.3	17.3
URBAN MASS TRANSPORTATION ADMINISTRATION	59.9	68.3	66.9	50.4	49.6	58.9
DEPARTMENT OF THE TREASURY, TOTAL	4.8	6.9	7.6	4.9	6.7	8.0
BUREAU OF ALCOHOL, TOBACCO AND FIREARMS	1.1	2.3	2.6	1.1	2.3	2.6
BUREAU OF ENGRAVING AND PRINTING	2.5	2.7	3.2	2.5	2.7	3.2
CUSTOMS SERVICE	1.2	1.9	2.0	1.3	1.7	2.2
OTHER AGENCIES						
ACTION	.5	1.3	5.6	.4	1.0	4.3
ADVISORY COMMISSION ON INTERGOVERNMENTAL RELATIONS	1.5	1.7	1.7	1.3	1.6	1.7
APPALACHIAN REGIONAL COMMISSION	.7	.8	.8	.6	.8	.8
CIVIL AERONAUTICS BOARD	.5	.7	.8	.5	.7	.8
CIVIL SERVICE COMMISSION	3.9	4.3	4.3	3.9	4.3	4.3
COMMUNITY SERVICES ADMINISTRATION	24.0	21.5	27.0	21.0	14.5	24.0
CONSUMER PRODUCT SAFETY COMMISSION	6.7	4.2	5.0	6.8	4.5	4.7
ENVIRONMENTAL PROTECTION AGENCY	295.5	311.0	330.0	281.3	310.0	313.0
FEDERAL COMMUNICATIONS COMMISSION	2.0	3.0	3.4	1.9	2.7	3.2
FEDERAL HOME LOAN BANK BOARD	1.7	1.1	1.3	1.7	1.1	1.3
FEDERAL TRADE COMMISSION	1.1	1.3	1.3	1.1	1.3	1.3
GENERAL SERVICES ADMINISTRATION	.9	2.2	1.1	.9	2.2	1.1
INTERNATIONAL COMMUNICATION AGENCY	.1	.2	.1	.1	.2	.1
INTERSTATE COMMERCE COMMISSION	.1	.2	.1	.1	.2	.1
LIBRARY OF CONGRESS	3.8	4.3	4.7	3.6	4.4	4.6
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION	3,703.4	3,876.5	4,192.5	3,840.3	3,869.1	4,116.1
NATIONAL SCIENCE FOUNDATION	697.0	753.6	828.7	649.6	715.3	749.1
NUCLEAR REGULATORY COMMISSION	112.3	132.1	155.0	101.7	120.7	144.5
SMALL BUSINESS ADMINISTRATION	.5	-	.1	.5	-	.1
SMITHSONIAN INSTITUTION	29.7	32.6	34.0	29.8	32.2	34.0
TENNESSEE VALLEY AUTHORITY	26.5	35.6	51.3	26.5	35.6	51.3
UNITED STATES ARMS CONTROL AND DISARMAMENT AGENCY	2.2	2.6	3.7	2.2	2.6	3.4
UNITED STATES INTERNATIONAL TRADE COMMISSION	2.6	2.6	2.7	2.6	2.6	2.7
VETERANS ADMINISTRATION	107.0	116.0	115.2	106.9	113.9	115.2

* INDICATES AMOUNT LESS THAN $50,000.

SOURCE: NATIONAL SCIENCE FOUNDATION.

☆ U.S. GOVERNMENT PRINTING OFFICE : 1979 O - 303-004

Other Science Resources Publications

REPORTS	NSF No.	Price
Projections of Science and Engineering Doctorate Supply and Utilization, 1982 and 1987	79-303	$2.25
Reviews of Data on Science Resources		
No. 33. "U.S. Industrial R&D Spending Abroad"	79-304	$0.70
No. 32. "Employment Patterns of Recent Entrants Into Science and Engineering"	78-310	$0.80
No. 31. "A Comparison of National Industrial R&D Estimates with Actual NSF/Census Data"	78-303	$0.80
No. 30. "Scientific and Technical Personnel in Private Industry, 1960-70 and 1975"	78-302	$0.80
No. 28. "Scientists and Engineers From Abroad, Trends of the Past Decade, 1966-75"	77-305	$0.35
DETAILED STATISTICAL TABLES		
Federal Support to Universities, Colleges, and Selected Nonprofit Institutions, Fiscal Year 1977	79-311	-----
Characteristics of Doctoral Scientists and Engineers in the United States, 1977	79-306	-----
U.S. Scientists and Engineers, 1976	79-305	-----
Expenditures for Scientific Activities at Universities and Colleges, Fiscal Year 1977	78-311	-----
Characteristics of Experienced Scientists and Engineers, 1976	78-305	-----
Human Resources for Scientific Activities at Universities and Colleges, January 1978	78-318	-----
Graduate Science Education: Student Support and Post-doctorals, Fall 1977	78-315	-----
HIGHLIGHTS		
Federal Obligations to Universities and Colleges Increased by 20% in FY 1977—Primarily for Nonscience Programs"	79-312	-----
"Manufacturing Industries with High Concentration of Scientists and Engineers Lead in 1965-77 Employment Growth"	79-307	-----
"Decline in Recent Science and Engineering Doctoral Faculty Continues into 1978"	79-301	-----
"Academic R&D Expenditures Continue Real Growth into 1977"	78-319	-----
"Work Activities of Doctoral Scientists and Engineers Show Substantial Change Between 1973 and 1977"	78-316	-----
"Hiring of Science and Engineering Faculty by 2- and 4-Year Colleges"	78-309	-----
"Graduate Science Enrollment Stabilized in 1977"	78-307	-----
"Utilization of Science and Engineering Doctorates in Industrial Research and Development"	78-301	-----
"Aptitude Test Scores of Prospective Graduate Students in Science Remained Essentially the Same From 1970 to 1975"	77-318	-----